AD-A057 005 STEVENS INST OF TECH HOBOKEN N J DAVIDSON LAB F/G 8/3

RADAR AND TUCKER WAVEMETER DATA FROM SEA-LAND MCLEAN - VOYAGE 6--ETC(U)

AUG 78 J F DALZELL N00024-74-C-5451

UNCLASSIFIED SIT-DL-77-1943 SSC-SL-7-22 NL

1 OF 2

AD A057 005

SL-7-22

RADAR AND TUCKER WAVEMETER DATA FROM SEA-LAND McLEAN VOYAGE 61

SHIP STRUCTURE COMMITTEE
1978

SL-7-22

TECHNICAL REPORT

on

Project SR-1221

"Correlation and Verification of

Wavemeter Data from the SL-7"

RADAR AND TUCKER WAVEMETER DATA

FROM SEA-LAND McLEAN

VOYAGE 61

by

J. F. Dalzell

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under

Department of the Navy
Naval Ship Engineering Center
Contract No. N00024-74-C-5451

U. S. Coast Guard Headquarters
Washington, D.C.
1978

ABSTRACT

So that more precise correlations between full scale observations and analytical and model results could be carried out, one of the objectives of the instrumentation program for the SL-7 class container ships was the provision of instrumental measures of the wave environment. To this end, two wave meter systems were installed on the S.S. SEA-LAND McLEAN. Raw data was collected from both systems during the second (1973-1974) and third (1974-1975) winter data collecting seasons.

It was the purpose of the present work to reduce this raw data, to develop and implement such corrections as were found necessary and feasible, and to correlate and evaluate the final results from the two wave meters. In carrying out this work it was necessary to at least partly reduce several other channels of recorded data, so that, as a by-product, reduced results were also obtained for midship bending stresses, roll, pitch, and two components of acceleration on the ship's bridge.

As the work progressed it became evident that the volume of documentation required would grow beyond the usual dimensions of a single technical report. For this reason the analyses, the methods, the detailed results, discussions, and conclusions are contained in a series of ten related reports.

This report is one of the six in the series in which the detailed results of the data reduction process are presented. Included in this report is the reduced data from the Third Season Voyage 61.

CONTENTS

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INTRODUCTION

It was one of the objectives of the SL-7 full-scale instrumentation program to provide a direct instrumental measure of the wave environment so that more precise correlations could be made between full-scale observations, and analytical and model results. To this end the ship was fitted with a micro-wave radar relative wave meter and various motion sensing devices. A "Tucker Meter" pressure actuated wave height sensing system was also installed.

The purpose of the present project is to reduce and analyze the resulting radar and Tucker meter data obtained on the SEA-LAND McLEAN in the second (1973-1974) and third (1974-1975) winter recording seasons. The purpose of the present report is to present the reduced data from the Third Season Voyage 61.

BACKGROUND

Since the purpose of the present report is only to document a portion of the reduced data, it should be noted that details of the experiments themselves, and of the analyses leading up to the present results, are contained elsewhere. To be specific, References 1 and 2 contain, for both recording seasons in question, a full account of the instrumentation, basic recording, and the nominal circumstances surrounding the present data. References 3 and 5 contain the detail of the reduction of the original data to digital form. Reference 4 contains the detail of the analyses and of the procedures used in generating the present results. Finally, Reference 6 contains the summary, discussion and conclusions.

NOTES ON THE CONTENTS

Each voyage leg was processed, and is presented, as a unit. The first part of the presentation for each voyage leg is a four-part table.

Parts a and b of each table contain the log-book data extracted from Ref. 1 or 2. With the exception of the first column of each page, the meaning of each entry is that established by Teledyne Materials Research. The first column is the run number assigned to each interval during the digitization at D.L. This number is retained for identification throughout.

Part c of each table is a comparison of results from the present digitization with that at TMR. Five columns are stress results obtained at TMR. Stresses are presented in thousands of pounds per square inch. The columns marked 6 through 8 are from the present digitization. Column 6 "range of recorded extremes" was computed from the first pass analysis by scaling the extremes in each interval and subtracting the smallest extreme from the largest. Column 7 is $2\sqrt{2}$ times the process rms. This estimate should compare with the value given by TMR for "rms P to T stress,". Column 8 is the difference of the sample mean of the interval noted, from the sample mean of the first interval digitized in each voyage leg. The remaining columns are various ratios of present results to those obtained by TMR.

Part d of the tables involves indices of the magnitude of <u>raw</u> radar, roll, pitch, vertical and transverse acceleration, and Tucker meter signals. The first index in each case is 4.0 x the rms. The second and third indices are the positive and negative extremes for each channel. The extremes observed for roll and pitch were corrected for electrical zero on tape before scaling. The extremes for all other items were corrected to the sample mean before scaling. The senses of pitch and Tucker meter are not correct for reasons noted in Ref. 4, and it is to be emphasized that all data is raw (uncorrected for anything).

The second part of the presentation for each voyage leg is a series of charts, a pair of charts for each interval. The first of the pair includes plots of spectra of midship vertical bending stress, roll, corrected radar wave elevation, Tucker meter wave, and the mean dynamic head at frame 119. The "mean dynamic head" is a partial correction of the Tucker meter as detailed in Ref. 4. At the left of the first chart is a tabulation of various data; portions of the log book data from the tables, two indices of midship stress, a summary of the magnitude of motions,

and finally a table summarizing wave height statistics obtained from spectra as well as peak-trough analyses of the time histories.

The second chart of the pair for each interval are sample time histories for five of the channels of information treated in the first chart. As noted in Reference 4, there was at the end of data reduction 16-1/2 minutes of valid radar wave elevation data. To produce the charts an 8-1/2 minute portion of this sample was selected.

A fuller discussion of the background and conventions employed in the charts is presented in the Appendix.

REFERENCES

1. Wheaton, J.W. and Boentgen, R.R., "Second Season Results from Ship Response Instrumentation Aboard the SL-7 Class Containership S.S. SEA-LAND McLEAN in North Atlantic Service," SL-7-9, 1976, AD-A034162.

2. Boentgen, R.R., "Third Season Results from Ship Response Instrumentation Aboard the SL-7 Class Containership S.S. SEA-LAND McLEAN in North Atlantic Service," SL-7-10, 1976, AD-A034175.

3. Dalzell, J.F., "Original Radar and Standard Tucker Wavemeter SL-7 Containership Data Reduction and Correlation Sample," SSC-277, SL-7-14. 1978.

4. Dalzell, J.F., "Wavemeter Data Reduction Method and Initial Data for the SL-7 Containership," SSC-278, SL-7-15. 1978.

5. Dalzell, J.F., "Modified Radar and Standard Tucker Wavemeter SL-7 Containership Data," SSC-279, SL-7-20. 1978.

6. Dalzell, J.F., "Results and Evaluation of the SL-7 Containership Radar and Tucker Wavemeter Data," SSC-280, SL-7-23. 1978.

TABLE Ia

SUMMARY OF TMR LOG-BOOK DATA CORRESPONDING TO
INTERVALS SELECTED FOR WAVE METER DATA REDUCTION (PAGE 1 OF 2)

SEA LAND MC LEAN : 1974-1975 WINTER SEASON : VOYAGE 61 EAST

D.L. RUN NO.	TMR TAPE NO.	TMR INDX NO.	TMR INTV NO.	DATE	TIME (GMT)	LATITUDE	LONGITUDE	COURSE	SPEED KT.	PROP RPM	DRAFT FT.	SEA/AIR TEMP
2518	223	5	18	03-01-75	1200	38-26 N	64-10 W	081	29.5	121.0		73/60
2524	223	6	24	03-01-75	1600	38-26 N	64-10 W	081	29.0	119.1		70/61
2528	223	7	28	03-01-75	2000	38-26 N	64-10 W	081	29.2	119.2		66/60
2530	223	8	30	03-01-75	2400	38-26 N	64-10 W	081	28.8	118.4		65/65
2536	223	9	36	03-02-75	0400	38-26 N	64-10 W	081	29.0	119.0		66/65
2539	223	10	39	03-02-75	0800	38-26 N	64-10 W	081	29.0	119.0		57/54
2541	223	11	41	03-02-75	1200	42-26 N	49-37 W	081	29.0	119.2		59/64
2547	223	12	47	03-02-75	1600	42-26 N	49-37 W	076	29.1	119.4		58/62
2551	223	13	51	03-02-75	2000	42-26 N	49-37 W	076	28.7	118.0		57/60
2553	223	14	53	03-02-75	2400	42-26 N	49-37 W	076	29.1	119.5		58/60
2557	223	15	57	03-03-75	0400	42-26 N	49-37 W	090	29.1	119.4		56/61
2601	225	16	1	03-03-75	0800	42-26 N	49-37 W	090	20.0	82.0		57/61
2609	225	18	9	03-03-75	1600	41-48 N	36-08 W	090	19.7	80.9		55/69
2617	225	20	17	03-03-75	2400	41-48 N	36-08 W	071	19.8	81.5		56/57
2625	225	22	25	03-04-75	0800	41-48 N	36-08 W	071	19.6	80.5		53/58
2633	225	24	33	03-04-75	1600	43-45 N	26-00 W	071	19.5	80.1		54/59
2641	225	26	41	03-04-75	2400	43-45 N	26-00 W	071	19.5	79.4		53/58
2649	225	28	49	03-05-75	0800	43-45 N	26-00 W	071	19.5	80.1		53/56
2657	225	30	57	03-05-75	1600	46-12 N	15-42 W	071	19.4	79.5		52/53

TABLE 1b

SUMMARY OF TMR LOG-BOOK DATA CORRESPONDING TO
INTERVALS SELECTED FOR WAVE METER DATA REDUCTION (PAGE 2 OF 2)

SEA LAND MC LEAN : 1974-1975 WINTER SEASON : VOYAGE 61 EAST

D.L. RUN NO.	SEA STATE	<REL WIND> DIR/SPEED /(KT)	REL WAVE DIR	WAVE HT. FT.	REL SWELL DIR	<-SWELL-> HT FT.	<-SWELL-> LENGTH FT.	VISUAL WEATHER /TMR LOG-BOOK COMMENTS
2518	4	144S/15	144S	3	144S	3	600	OCAST /
2524	7	121S/30	121S	4	144S	6	600	RAIN FOG / ROLLING 10 DEG PORT 5 STB
2528	8	88S/35	88S	6	99S	8	600	RAIN /
2530	8	88S/40	88S	6	99S	8	600	RAIN LIGHTNING /
2536	8	99S/40	99S	6	99S	8	600	RAIN LIGHTNING / HEAVY ROLL
2539	6	54S/25	54S	4	99S	6	600	OCAST /
2541	6	99S/25	99S	4	99S	6	600	OCAST / SLOW HEAVY ROLL
2547	6	126S/25	126S	4	149S	6	800	OCAST /
2551	3	149S/10	149S	4	149S	6	800	OCAST /
2553	4	177P/15	177P	4	149S	6	800	OCAST /
2557	4	169S/15	169S	3	149S	6	600	PT CLDY /
2601	6	157S/25	157S	2	157S	5	600	PT CLDY /
2609	3	180 /10	180	1	146S	4	600	CLEAR /
2617	4	159P/15	159P	1	159P	4	600	CLEAR /
2625	4	159P/15	159P	1	159P	3	600	OCAST /
2633	3	159P/10	159P	1	159P	3	600	FOG OCAST /
2641	3	159P/10	159P	1	159P	3	800	FOG RAIN /
2649	2	159P/ 5	159P	1	159P	2	800	FOG RAIN /
2657	4	131S/15	131S	2	131S	2	800	FOG RAIN /

TABLE Ic

COMPARISON OF TMR RESULTS FOR MIDSHIP VERTICAL BENDING STRESS
WITH CORRESPONDING RAW DIGITIZATION RESULTS AT DAVIDSON LABORATORY

SEA LAND MC LEAN : 1974-1975 WINTER SEASON : VOYAGE 61 EAST

D.L. RUN NO.	TMR RESULTS: NO. WAVE INDUCED CYCLES (1)	NO. 1ST MODE BURSTS (2)	MAX P-TO-T STRESS KPSI (3)	RMS P-TO-T STRESS KPSI (4)	MAX 1ST MODE STRESS KPSI (5)	D.L. DIGITIZATION: RANGE OF RECORDED EXTREMES KPSI (6)	2.83X (SAMPLE RMS) KPSI (7)	REL MEAN STRESS KPSI (8)	COLUMN RATIOS: (7) / (4)	(6) / (3+5)	(6) / (3)
2518	106	11	4.82	1.99	1.30	5.12	2.09	0.57	1.05	0.84	1.06
2524	100	32	6.87	3.01	1.56	8.23	3.15	2.67	1.05	0.98	1.20
2528	92	35	6.69	3.37	1.64	8.33	3.47	0.89	1.03	1.00	1.25
2530	91	34	5.75	2.81	1.28	7.90	3.06	0.70	1.09	1.13	1.38
2536	165	41	4.23	2.11	1.70	7.67	2.86	0.67	1.35	1.29	1.81
2539	122	29	6.63	2.77	1.27	8.53	3.10	0.69	1.12	1.08	1.29
2541	112	17	5.49	2.63	1.37	7.45	3.01	0.25	1.14	1.09	1.36
2547	96	9	6.95	3.16	1.22	8.51	3.43	0.16	1.08	1.04	1.22
2551	70	14	11.41	3.97	1.11	10.50	4.25	0.38	1.07	0.84	0.92
2553	67	5	8.13	4.17	0.95	9.50	4.20	-0.30	1.01	1.05	1.17
2557	76	7	7.36	3.65	1.05	8.90	3.84	-0.37	1.05	1.06	1.21
2601	74	0	8.28	3.93	0.00	9.15	4.00	0.51	1.02	1.11	1.11
2609	76	0	7.54	3.46	0.00	8.37	3.27	1.22	0.94	1.11	1.11
2617	68	0	8.21	3.25	0.00	7.39	3.06	1.86	0.94	0.90	0.90
2625	86	0	5.10	2.09	0.00	5.34	2.40	1.68	1.15	1.05	1.05
2633	75	0	4.12	2.47	0.00	5.48	2.55	1.48	1.03	1.33	1.33
2641	73	0	5.66	2.45	0.00	6.45	2.30	2.03	0.94	1.14	1.14
2649	70	0	4.81	2.19	0.00	4.85	2.33	1.89	1.06	1.01	1.01
2657	73	0	4.99	2.10	0.20	21.02**	2.19	1.81	1.04	4.22	4.22

**Probable tape saturation or unrelated transient.

TABLE Id

SUMMARY OF RAW DIGITIZATION RESULTS FOR RADAR RANGE
ROLL, PITCH, DECK HOUSE ACCELERATIONS, AND TUCKER METER

SEA LAND MC LEAN : 1974-1975 WINTER SEASON : VOYAGE 61 EAST

D.L.	<--- RADAR	--->		<--- ROLL	---->		<--- PITCH	--->		<--VERT	ACCEL->		<--LAT	ACCEL-->		<-- TUCKER	-->	
RUN	4.0 (RMS)	RECORDED EXTREMES		4.0 (RMS)	RECORDED EXTREMES		4.0 (RMS)	RECORDED EXTREMES		4.0 (RMS)	RECORDED EXTREMES		4.2 (RMS)	RECORDED EXTREMES		4.0 (RMS)	RECORDED EXTREMES	
NO.	FT	FT	FT	DEG	DEG	DEG	DEG	DEG	DEG	(G)	(G)	(G)	(G)	(G)	(G)	FT	FT	FT
2518	22.	20.	-29.	9.6	3.	-11.	0.8	0.2	-1.2	0.20	0.2	-0.2	0.14	0.1	-0.1	2.	2.	-3.
2524	31.	30.	-43.	16.3	10.	-18.	1.2	1.0	-1.6	0.26	0.3	-0.3	0.31	0.3	-0.3	3.	3.	-3.
2528	32.	28.	-23.	16.0	3.	-17.	1.0	2.5	-1.5	0.32	0.3	-0.3	0.32	0.2	-0.2	5.	3.	-5.
2530	32.	31.	-24.	16.1	5.	-18.	1.2	2.4	-1.3	0.28	0.3	-0.2	0.30	0.2	-0.2	4.	3.	-4.
2536	31.	28.	-30.	10.8	4.	-15.	1.2	2.6	-1.8	0.35	0.3	-0.3	0.21	0.2	-0.2	5.	3.	-5.
2539	31.	27.	-22.	14.0	6.	-16.	1.2	2.7	-1.6	0.35	0.3	-0.3	0.27	0.2	-0.2	5.	4.	-4.
2541	31.	24.	-23.	14.8	5.	-16.	1.0	2.6	-1.6	0.32	0.3	-0.3	0.28	0.2	-0.2	5.	4.	-4.
2547	41.	39.	-45.	23.4	11.	-24.	0.9	2.3	-1.7	0.29	0.3	-0.2	0.44	0.4	-0.3	5.	3.	-4.
2551	52.	51.	-49.	27.9	13.	-27.	0.9	0.4	-1.5	0.28	0.3	-0.3	0.52	0.4	-0.4	4.	4.	-4.
2553	44.	35.	-36.	24.7	11.	-27.	0.9	0.2	-1.7	0.28	0.3	-0.2	0.44	0.4	-0.3	5.	3.	-4.
2557	47.	50.	-42.	27.9	17.	-28.	0.9	2.3	-1.6	0.29	0.3	-0.2	0.51	0.4	-0.4	5.	3.	-4.
2601	35.	29.	-36.	16.2	8.	-17.	0.7	2.1	-1.5	0.22	0.2	-0.2	0.31	0.3	-0.3	5.	3.	-4.
2609	25.	20.	-22.	10.1	4.	-11.	0.7	2.1	-1.3	0.20	0.2	-0.2	0.22	0.2	-0.2	4.	3.	-3.
2617	18.	14.	-14.	8.2	6.	-8.	0.8	2.1	-1.1	0.20	0.2	-0.1	0.17	0.2	-0.1	3.	3.	-2.
2625	18.	15.	-18.	8.3	7.	-6.	0.8	2.2	-0.9	0.19	0.2	-0.2	0.17	0.1	-0.1	3.	2.	-2.
2633	18.	16.	-14.	7.6	5.	-7.	0.7	2.2	-1.0	0.18	0.2	-0.2	0.16	0.1	-0.1	3.	2.	-2.
2641	17.	14.	-16.	6.8	4.	-7.	0.7	2.1	-1.0	0.15	0.1	-0.1	0.15	0.1	-0.1	2.	2.	-2.
2649	13.	11.	-12.	6.6	4.	-8.	0.7	2.0	-1.0	0.15	0.1	-0.1	0.14	0.1	-0.1	2.	1.	-2.
2657	13.	12.	-11.	6.5	3.	-9.	0.7	-2.0	-1.0	0.14	0.1	-0.1	0.14	0.1	-0.1	2.	2.	-2.

LOG BOOK DATA	
DATE AND TIME	03-01-75 1200
POSITION	38-26 N 64-10 W
COURSE AND SPEED	081 . 29.5 KNOTS
SEA STATE	4
WAVE HEIGHT	3 FEET
" REL DIR	144 STBD
SWELL HEIGHT	3 FEET
" REL DIR	144 STBD

---- VISUAL WEATHER / COMMENTS ----

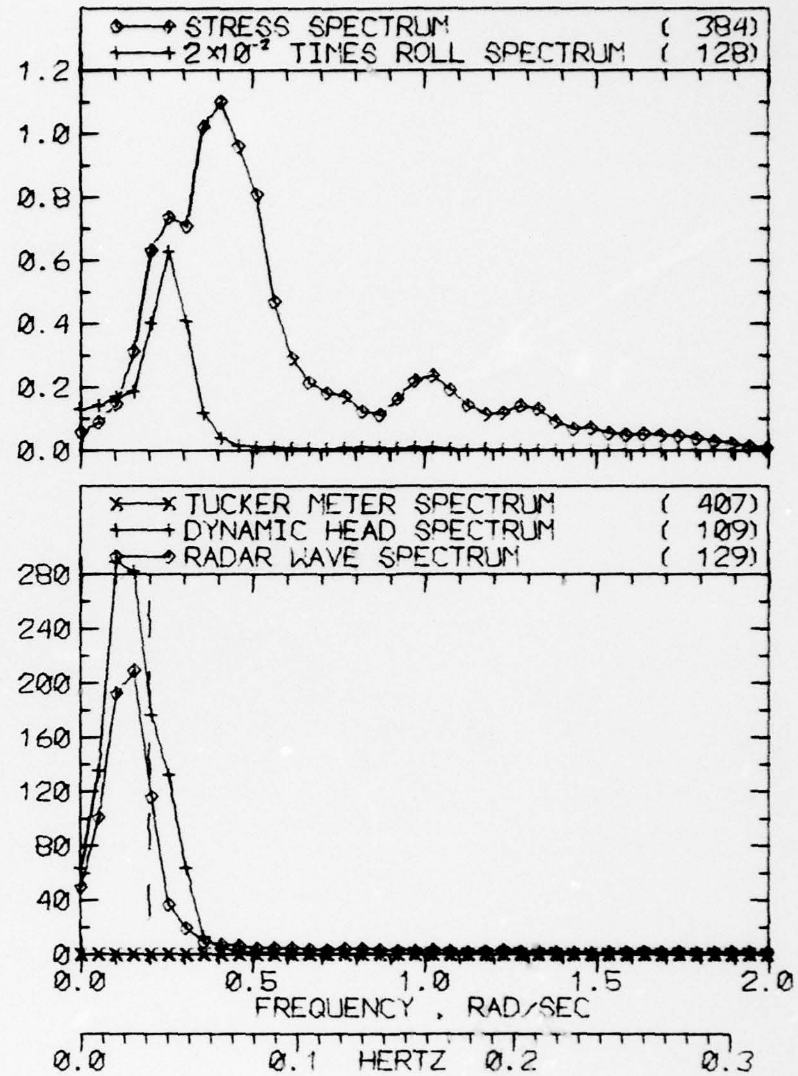
OCAST /

MIDSHIP VERTICAL BENDING STRESS	
MAXIMUM PK-TR	4.8 KPSI
4.0 X RMS	3.0 KPSI

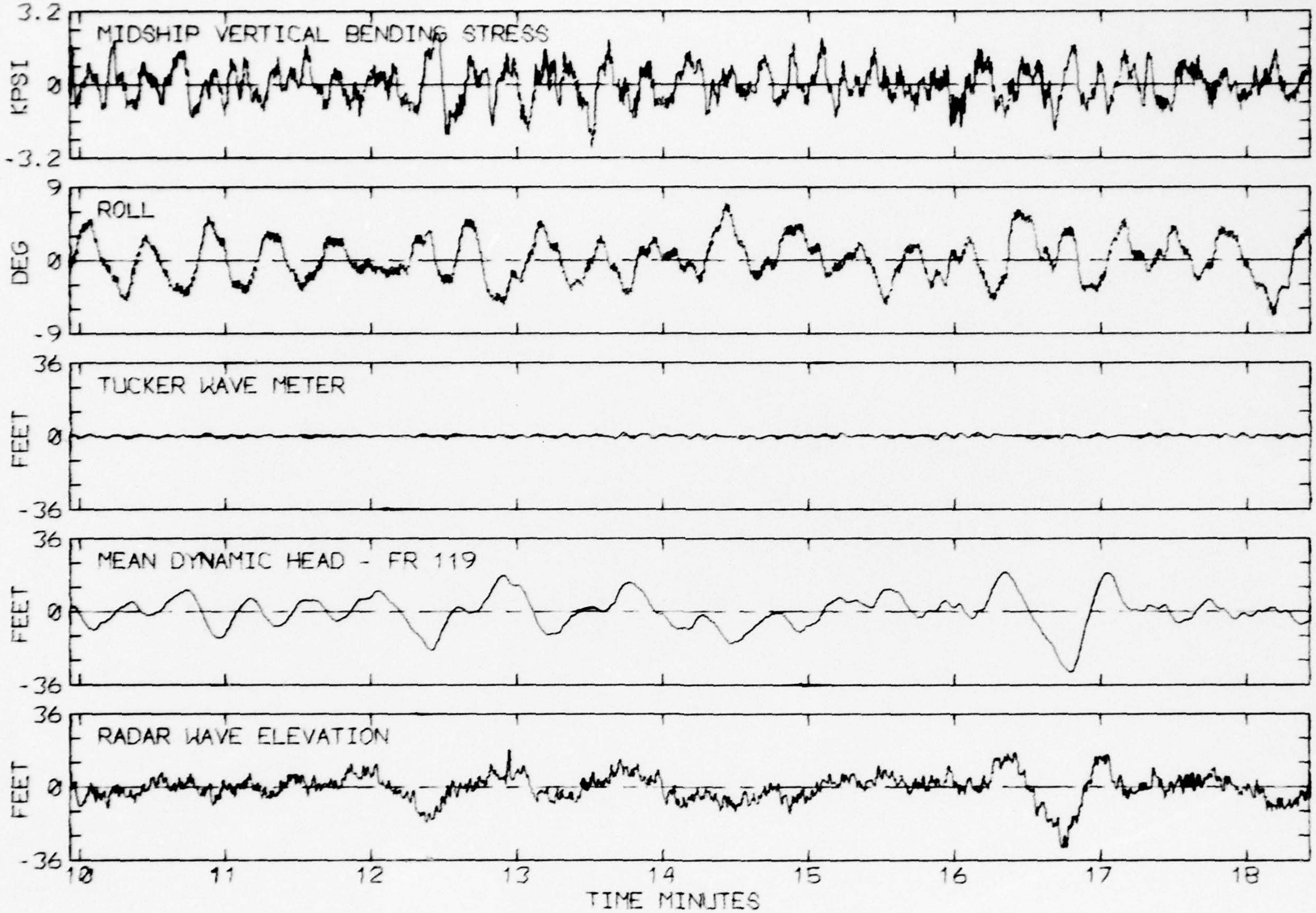
SUMMARY OF MOTIONS (4.0 X RMS)	
ROLL	9.7 DEG
PITCH	0.79 DEG
DK HSE VERT ACCEL	0.20 G
DK HSE LAT ACCEL	0.14 G
RADAR SLANT RANGE	21.9 FEET
VERTICAL RANGE	19.1 FEET
DISPL AT RADAR	29.6 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	545	37	260
MAXIMUM HEIGHT	2.9	49.0	31.8
10TH HIGHEST HTS	1.5	32.8	16.7
3RD HIGHEST HTS	1.0	24.9	10.8
4.0 RMS(SPECTRA)	2.1	30.5	26.2



RUN 2518 -- VOYAGE 61E -- TAPE 223 -- INDEX 5 -- INTERVAL 18



RUN 2518 -- VOYAGE 61E -- TAPE 223 -- INDEX 5 -- INTERVAL 18

LOG BOOK DATA

DATE AND TIME	03-01-75 1600
POSITION	38-26 N 64-10 W
COURSE AND SPEED	081 . 29.0 KNOTS
SEA STATE	7
WAVE HEIGHT	4 FEET
" REL DIR	121 STBD
SWELL HEIGHT	6 FEET
" REL DIR	144 STBD

---- VISUAL WEATHER / COMMENTS ----

RAIN FOG / ROLLING 10 DEG PORT 5 STB

MIDSHIP VERTICAL BENDING STRESS

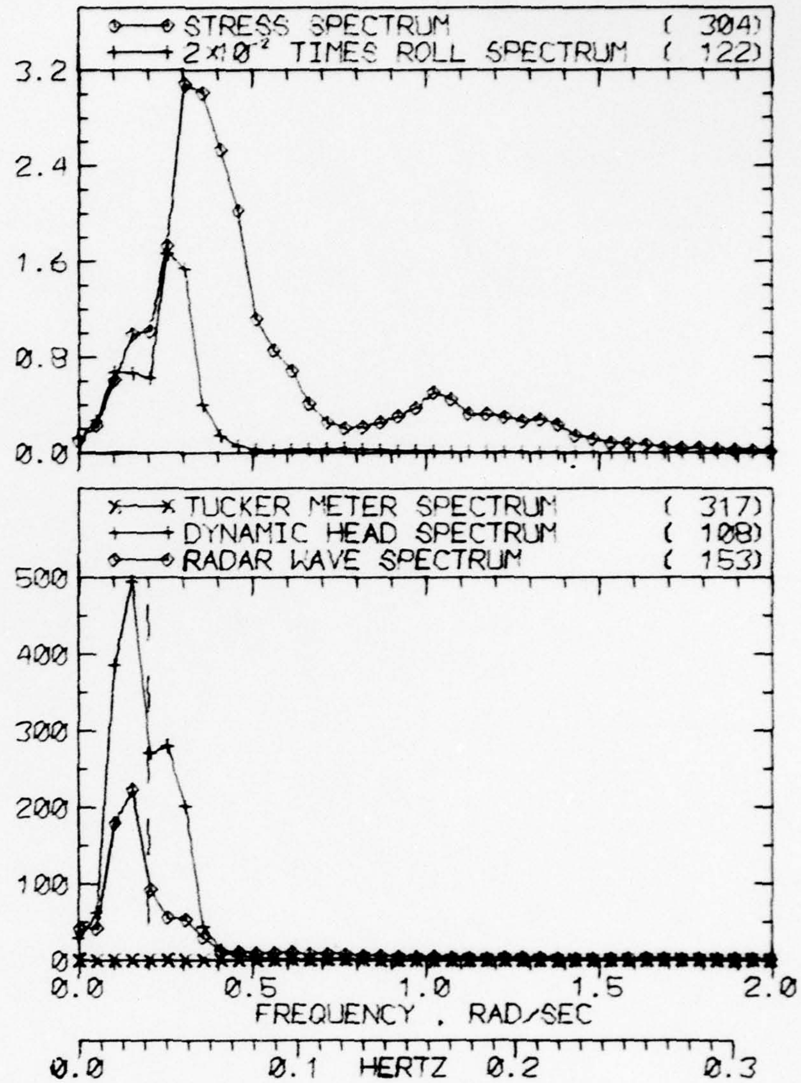
MAXIMUM PK-TR	6.9 KPSI
4.0 X RMS	4.5 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

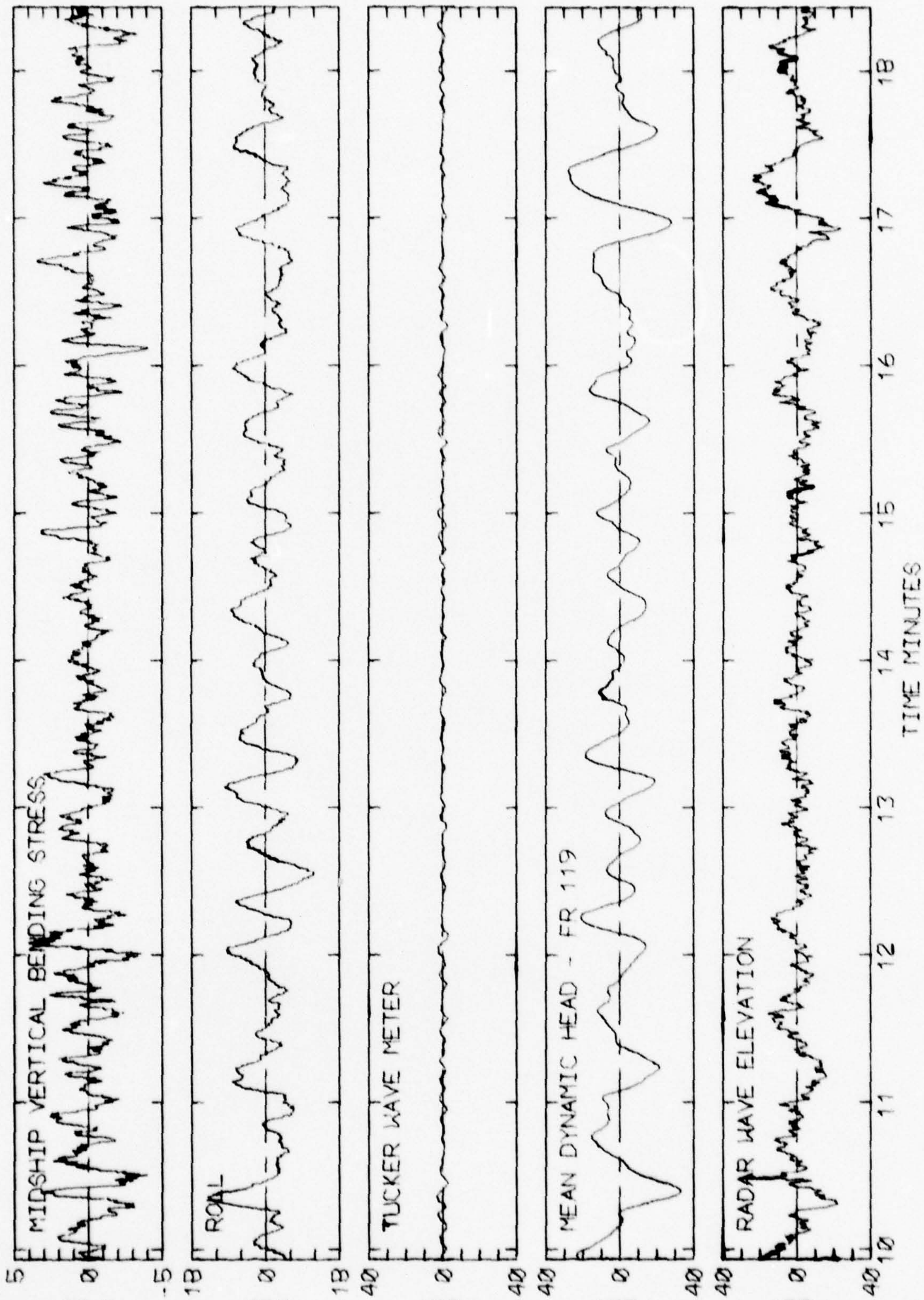
ROLL	16.2 DEG
PITCH	0.96 DEG
DK HSE VERT ACCEL	0.26 G
DK HSE LAT ACCEL	0.31 G
RADAR SLANT RANGE	31.2 FEET
VERTICAL RANGE	25.3 FEET
DISPL AT RADAR	38.0 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER	/DYN. HEAD	/RADAR
P-T SAMPLE SIZE	285	39	197
MAXIMUM HEIGHT	6.0	48.2	39.3
10TH HIGHEST HTS	3.4	39.9	22.1
3RD HIGHEST HTS	2.3	31.9	14.8
4.0 RMS(SPECTRA)	3.4	38.2	26.8



RUN 2524 -- VOYAGE 61E -- TAPE 223 -- INDEX 6 -- INTERVAL 24



RUN 2524 -- VOYAGE 61E -- TAPE 223 -- INDEX 6 -- INTERVAL 24

LOG BOOK DATA	
DATE AND TIME	03-01-75 2000
POSITION	38-26 N 64-10 W
COURSE AND SPEED	081 , 29.0 KNOTS
SEA STATE	8
WAVE HEIGHT	6 FEET
" REL DIR	88 STBD
SWELL HEIGHT	8 FEET
" REL DIR	99 STBD

---- VISUAL WEATHER / COMMENTS ----

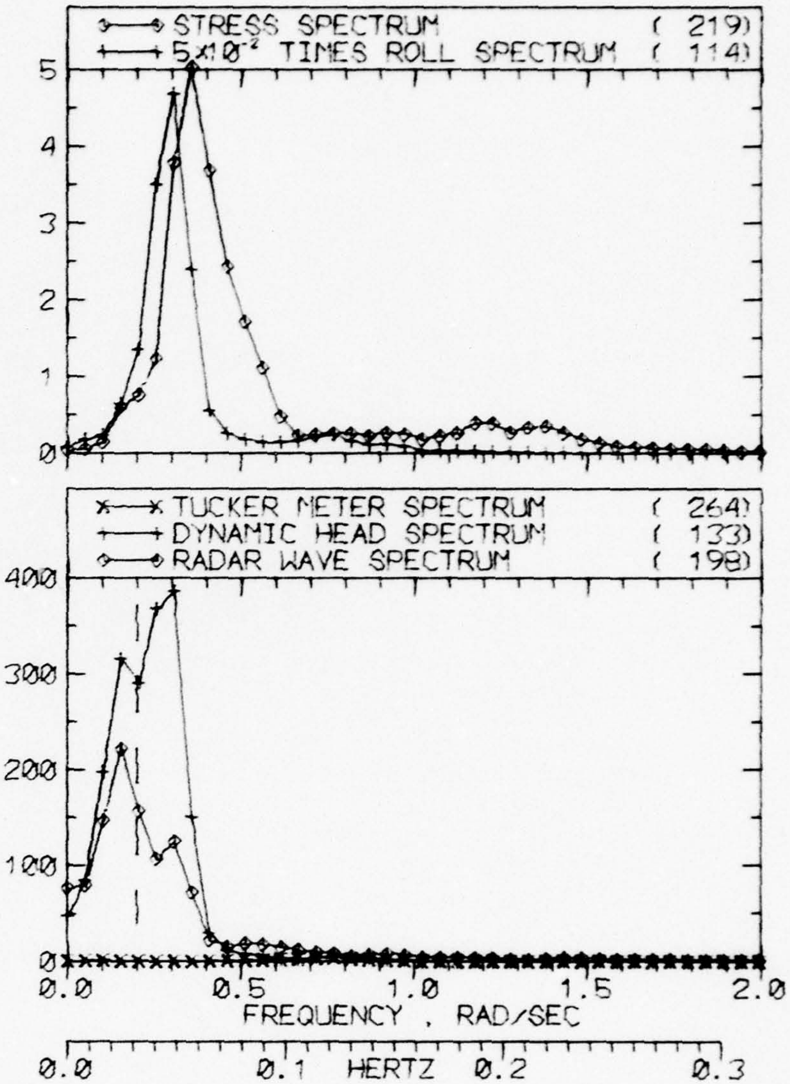
RAIN /

MIDSHIP VERTICAL BENDING STRESS	
MAXIMUM PK-TR	6.7 KPSI
4.0 X RMS	4.7 KPSI

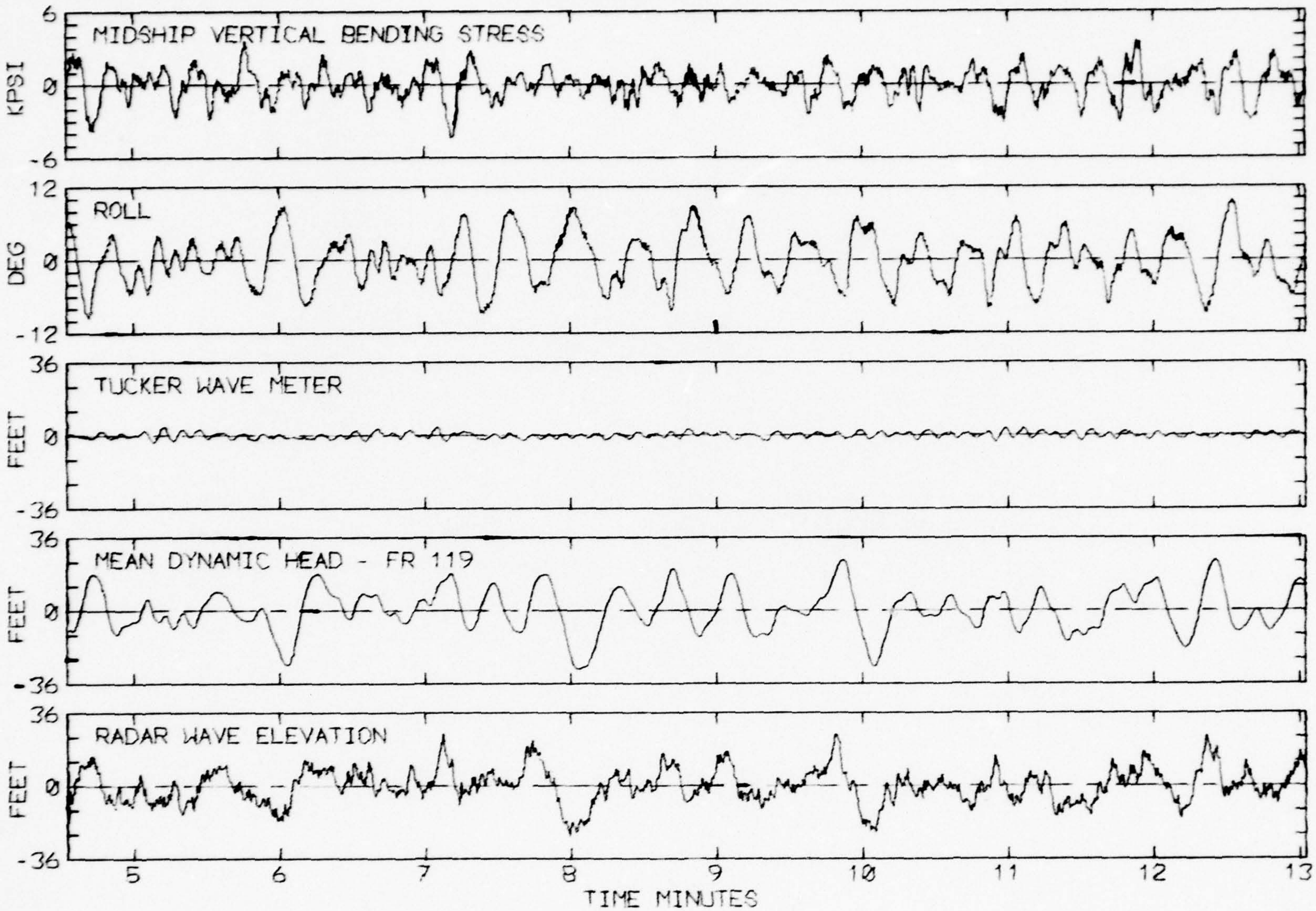
SUMMARY OF MOTIONS (4.0 X RMS)	
ROLL	16.0 DEG
PITCH	1.03 DEG
DK HSE VERT ACCEL	0.32 G
DK HSE LAT ACCEL	0.32 G
RADAR SLANT RANGE	32.1 FEET
VERTICAL RANGE	26.6 FEET
DISPL AT RADAR	41.8 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/	DYN. HEAD/	RADAR
P-T SAMPLE SIZE	207	45	188
MAXIMUM HEIGHT	7.0	52.1	47.0
10TH HIGHEST HTS	4.9	44.0	27.6
3RD HIGHEST HTS	3.7	35.2	17.3
4.0 RMS(SPECTRA)	5.0	39.4	31.0



RUN 2528 -- VOYAGE 61E -- TAPE 223 -- INDEX 7 -- INTERVAL 28



RUN 2528 -- VOYAGE 61E -- TAPE 223 -- INDEX 7 -- INTERVAL 28

LOG BOOK DATA	
DATE AND TIME	03-01-75 2400
POSITION	38-26 N 64-10 W
COURSE AND SPEED	081 , 28.8 KNOTS
SEA STATE	8
WAVE HEIGHT	6 FEET
" REL DIR	88 STBD
SWELL HEIGHT	8 FEET
" REL DIR	99 STBD

---- VISUAL WEATHER / COMMENTS ----

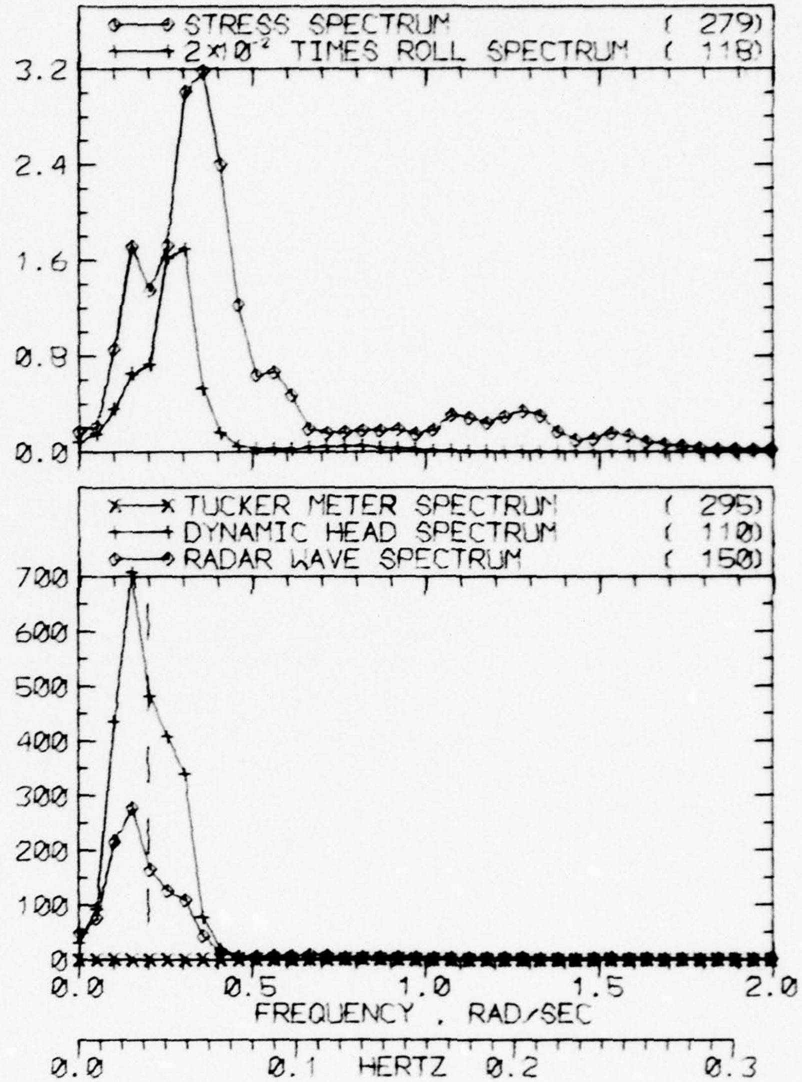
RAIN LIGHTNING /

MIDSHIP VERTICAL BENDING STRESS	
MAXIMUM PK-TR	5.7 KPSI
4.0 X RMS	4.3 KPSI

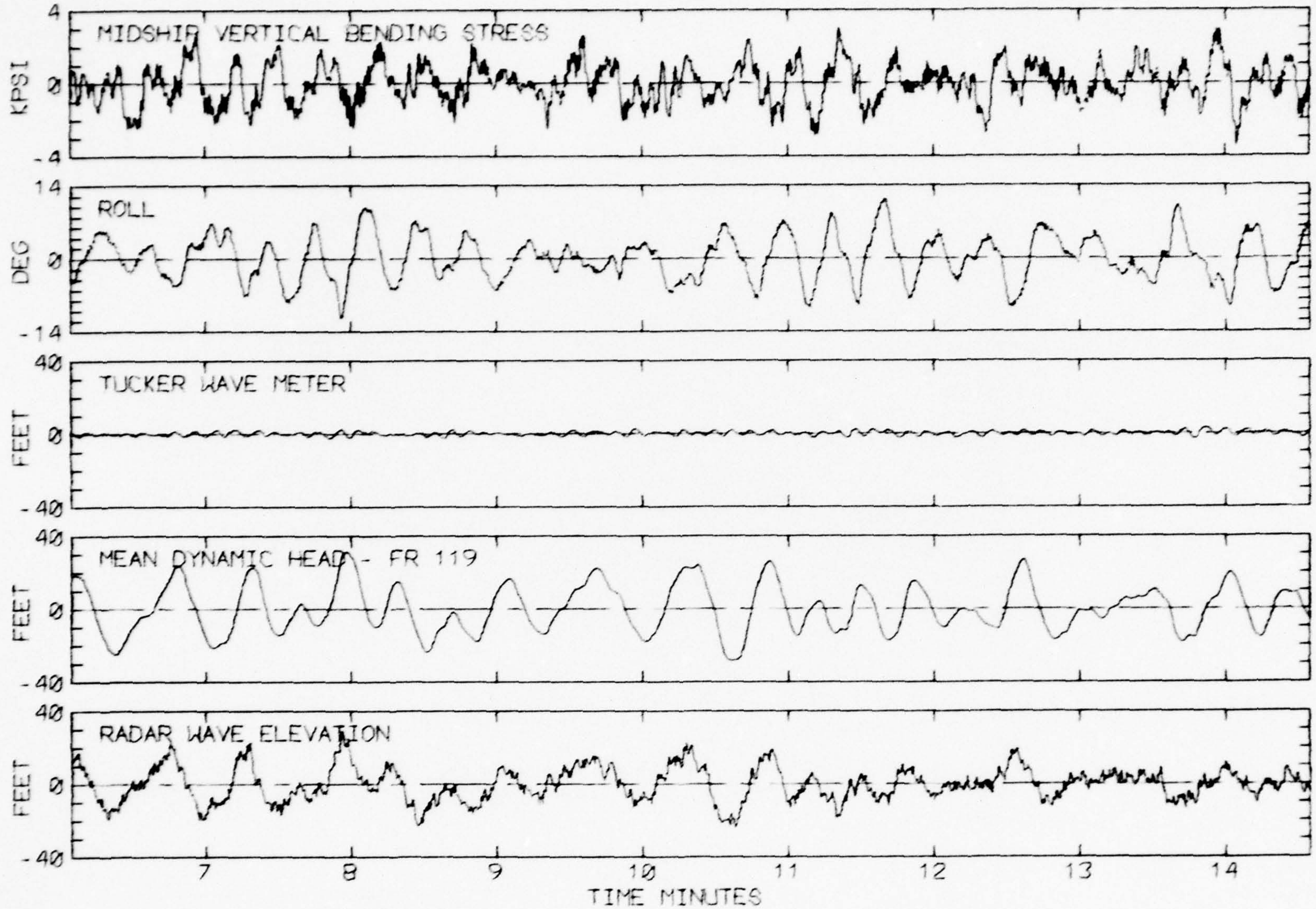
SUMMARY OF MOTIONS (4.0 X RMS)	
ROLL	16.2 DEG
PITCH	0.97 DEG
DK HSE VERT ACCEL	0.28 G
DK HSE LAT ACCEL	0.30 G
RADAR SLANT RANGE	31.5 FEET
VERTICAL RANGE	25.7 FEET
DISPL AT RADAR	44.6 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER	/DYN. HEAD	/RADAR
P-T SAMPLE SIZE	262	35	165
MAXIMUM HEIGHT	5.8	52.2	45.6
10TH HIGHEST HTS	3.7	47.7	25.3
3RD HIGHEST HTS	2.7	41.7	16.7
4.0 RMS(SPECTRA)	3.8	46.1	31.2



RUN 2530 -- VOYAGE 61E -- TAPE 223 -- INDEX 8 -- INTERVAL 30



RUN 2530 -- VOYAGE 61E -- TAPE 223 -- INDEX 8 -- INTERVAL 30

LOG BOOK DATA	
DATE AND TIME	03-02-75 0400
POSITION	38-26 N 64-10 W
COURSE AND SPEED	081 . 29.0 KNOTS
SEA STATE	8
WAVE HEIGHT	6 FEET
" REL DIR	99 STBD
SWELL HEIGHT	8 FEET
" REL DIR	99 STBD

---- VISUAL WEATHER / COMMENTS ----

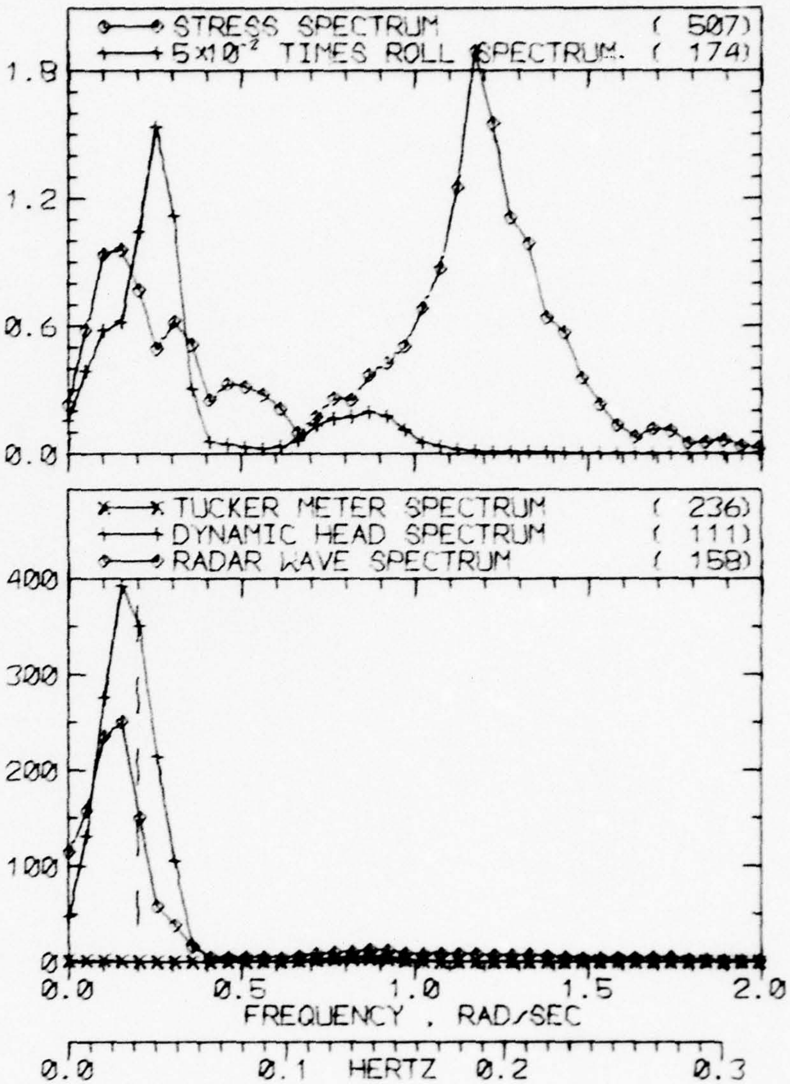
RAIN LIGHTNING / HEAVY ROLL

MIDSHIP VERTICAL BENDING STRESS	
MAXIMUM PK-TR	4.2 KPSI
4.0 X RMS	4.1 KPSI

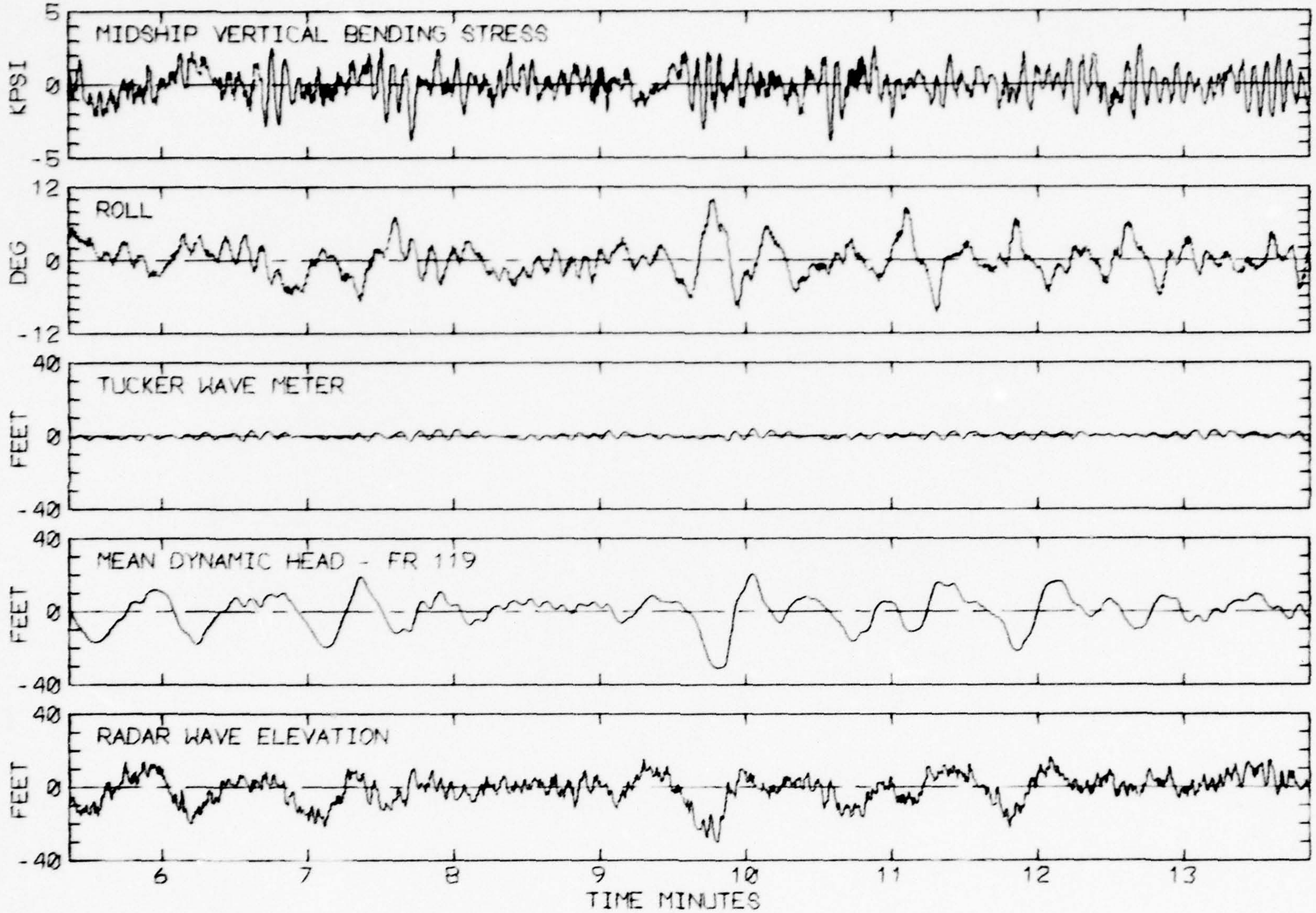
SUMMARY OF MOTIONS (4.0 X RMS)	
ROLL	10.8 DEG
PITCH	1.19 DEG
DK HSE VERT ACCEL	0.35 G
DK HSE LAT ACCEL	0.21 G
RADAR SLANT RANGE	31.2 FEET
VERTICAL RANGE	26.8 FEET
DISPL AT RADAR	35.2 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	233	39	190
MAXIMUM HEIGHT	6.7	42.0	33.9
10TH HIGHEST HTS	5.2	34.3	23.5
3RD HIGHEST HTS	3.7	28.3	16.4
4.0 RMS(SPECTRA)	4.8	35.6	31.2



RUN 2536 -- VOYAGE 61E -- TAPE 223 -- INDEX 9 -- INTERVAL 36



RUN 2536 -- VOYAGE 61E -- TAPE 223 -- INDEX 9 -- INTERVAL 36

LOG BOOK DATA	
DATE AND TIME	03-02-75 0800
POSITION	38-26 N 64-10 W
COURSE AND SPEED	081 , 29.0 KNOTS
SEA STATE	6
WAVE HEIGHT	4 FEET
" REL DIR	54 STBD
SWELL HEIGHT	6 FEET
" REL DIR	99 STBD

---- VISUAL WEATHER / COMMENTS ----

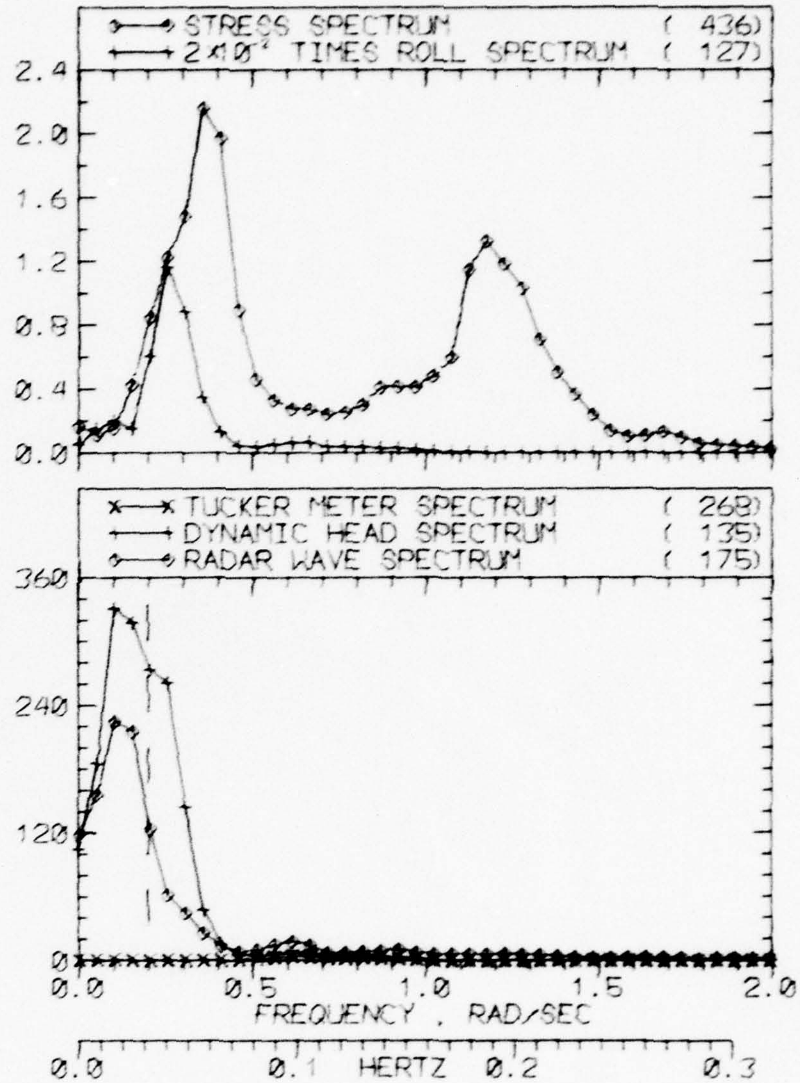
OCAST /

MIDSHIP VERTICAL BENDING STRESS	
MAXIMUM PK-TR	6.6 KPSI
4.0 X RMS	4.3 KPSI

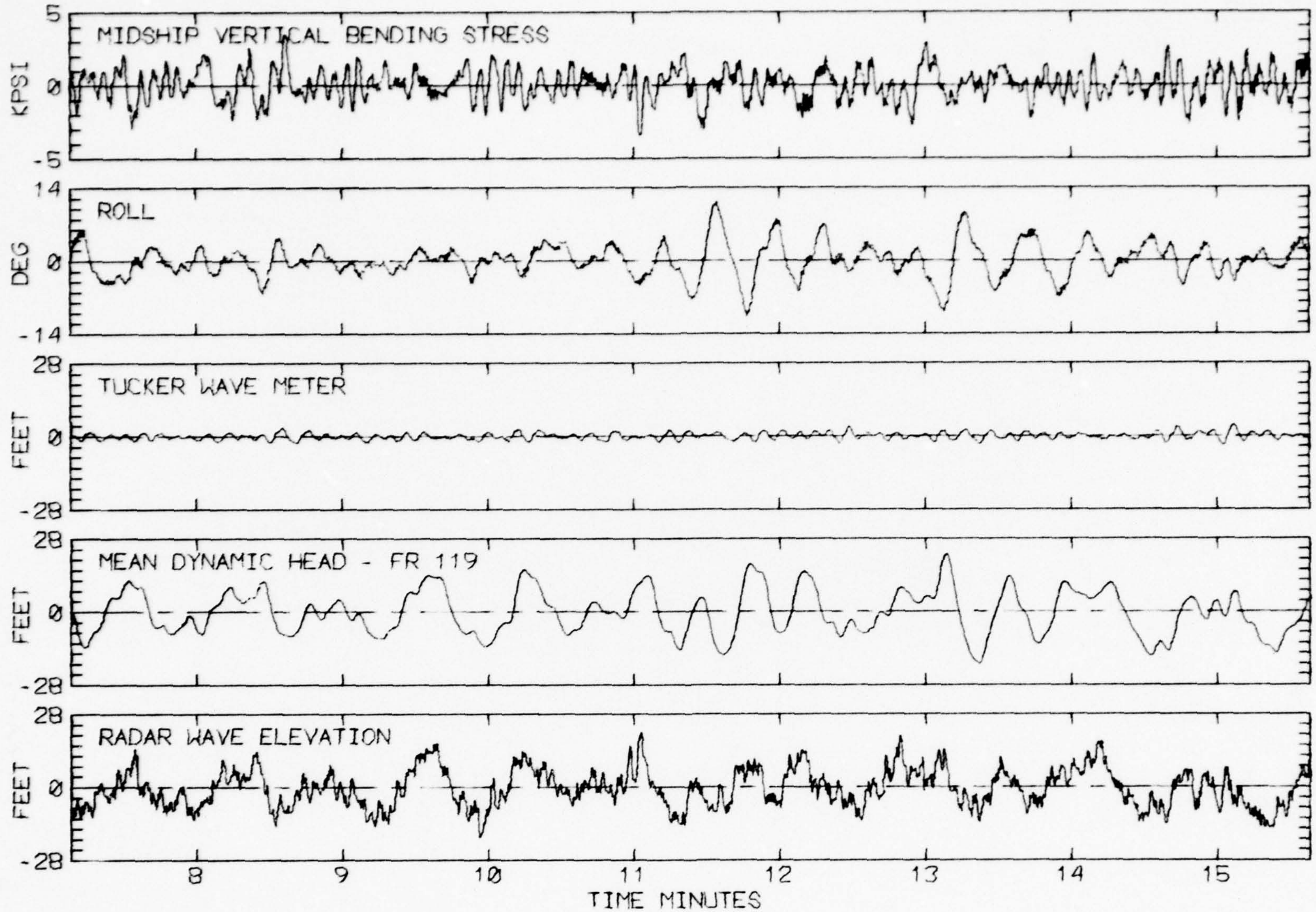
SUMMARY OF MOTIONS (4.0 X RMS)	
ROLL	13.1 DEG
PITCH	1.21 DEG
DK HSE VERT ACCEL	0.35 G
DK HSE LAT ACCEL	0.27 G
RADAR SLANT RANGE	30.8 FEET
VERTICAL RANGE	25.7 FEET
DISPL AT RADAR	38.8 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN. HEAD/RADAR		
P-T SAMPLE SIZE	195	39	176
MAXIMUM HEIGHT	6.8	41.6	35.6
10TH HIGHEST HTS	5.6	33.9	22.9
3RD HIGHEST HTS	4.1	29.1	16.7
4.0 RMS(SPECTRA)	5.1	37.0	30.7



RUN 2539 -- VOYAGE 61E -- TAPE 223 -- INDEX 10 -- INTERVAL 39



RUN 2539 -- VOYAGE 61E -- TAPE 223 -- INDEX 10 -- INTERVAL 39

LOG BOOK DATA	
DATE AND TIME	03-02-75 1200
POSITION	40-26 N 49-37 W
COURSE AND SPEED	081 . 29.0 KNOTS
SEA STATE	6
WAVE HEIGHT	4 FEET
" REL DIR	99 STBD
SWELL HEIGHT	6 FEET
" REL DIR	99 STBD

---- VISUAL WEATHER / COMMENTS ----

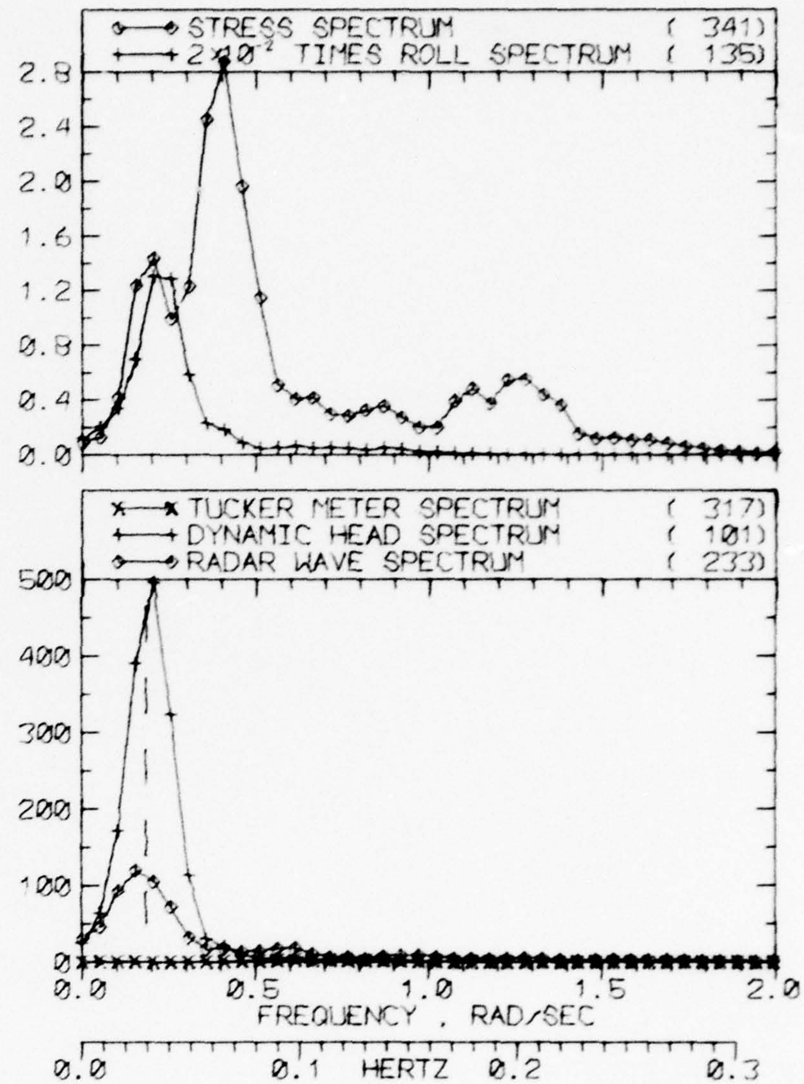
OCAST / SLOW HEAVY ROLL

MIDSHIP VERTICAL BENDING STRESS	
MAXIMUM PK-TR	5.5 KPSI
4.0 X RMS	4.2 KPSI

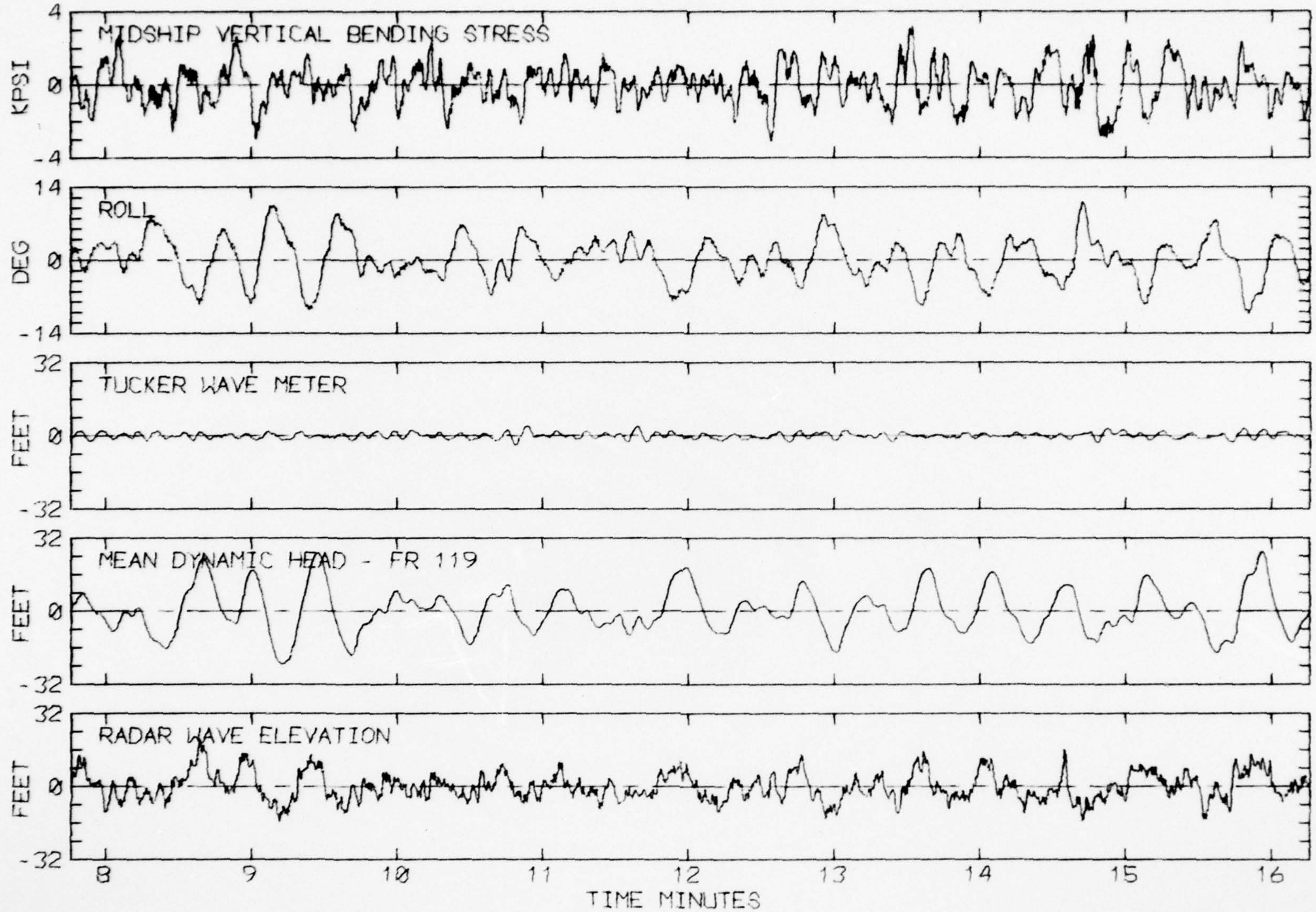
SUMMARY OF MOTIONS (4.0 X RMS)	
ROLL	15.0 DEG
PITCH	1.05 DEG
DK HSE VERT ACCEL	0.32 G
DK HSE LAT ACCEL	0.28 G
RADAR SLANT RANGE	31.1 FEET
VERTICAL RANGE	26.3 FEET
DISPL AT RADAR	37.5 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	249	41	206
MAXIMUM HEIGHT	6.8	44.4	32.7
10TH HIGHEST HTS	4.5	40.5	19.8
3RD HIGHEST HTS	3.2	32.5	14.4
4.0 RMS(SPECTRA)	4.7	36.9	24.4



RUN 2541 -- VOYAGE 61E -- TAPE 223 -- INDEX 11 -- INTERVAL 41



RUN 2541 -- VOYAGE 61E -- TAPE 223 -- INDEX 11 -- INTERVAL 41

LOG BOOK DATA	
DATE AND TIME	03-02-75 1600
POSITION	40-26 N 49-37 W
COURSE AND SPEED	076 , 29.1 KNOTS
SEA STATE	6
WAVE HEIGHT	4 FEET
" REL DIR	126 STBD
SWELL HEIGHT	6 FEET
" REL DIR	149 STBD

---- VISUAL WEATHER / COMMENTS ----

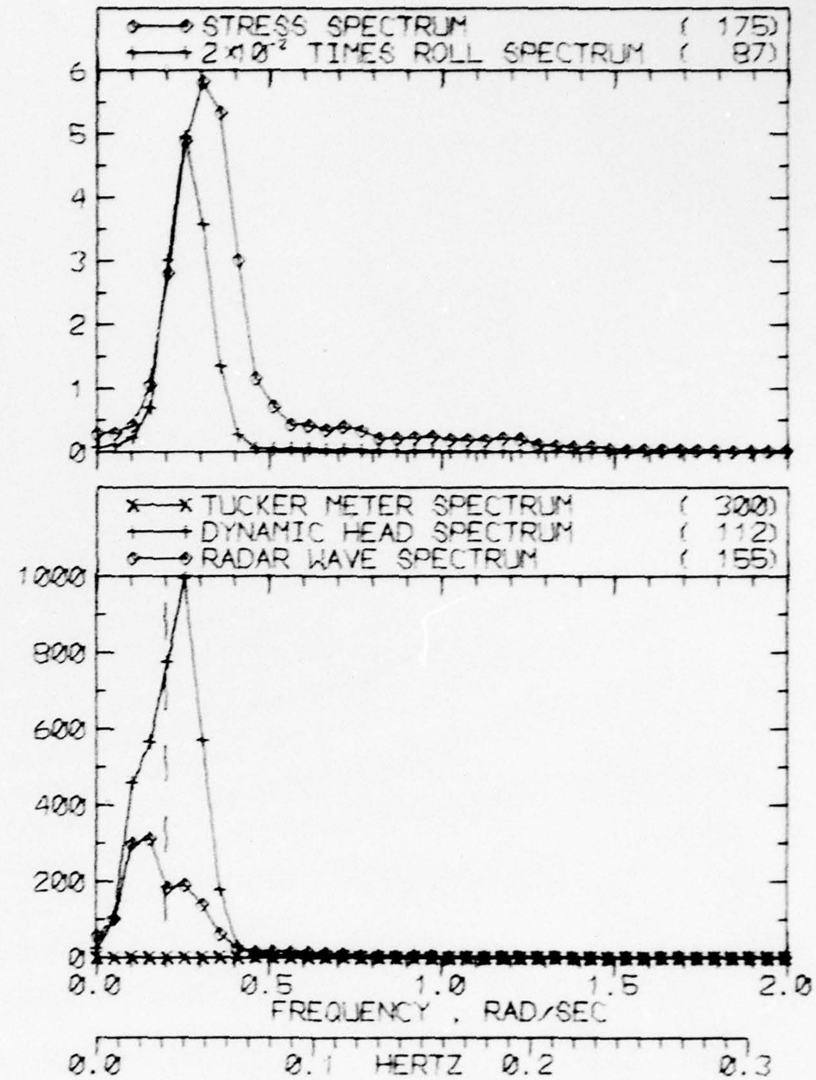
OCAST /

MIDSHIP VERTICAL BENDING STRESS	
MAXIMUM PK-TR	6.9 KPSI
4.0 X RMS	5.0 KPSI

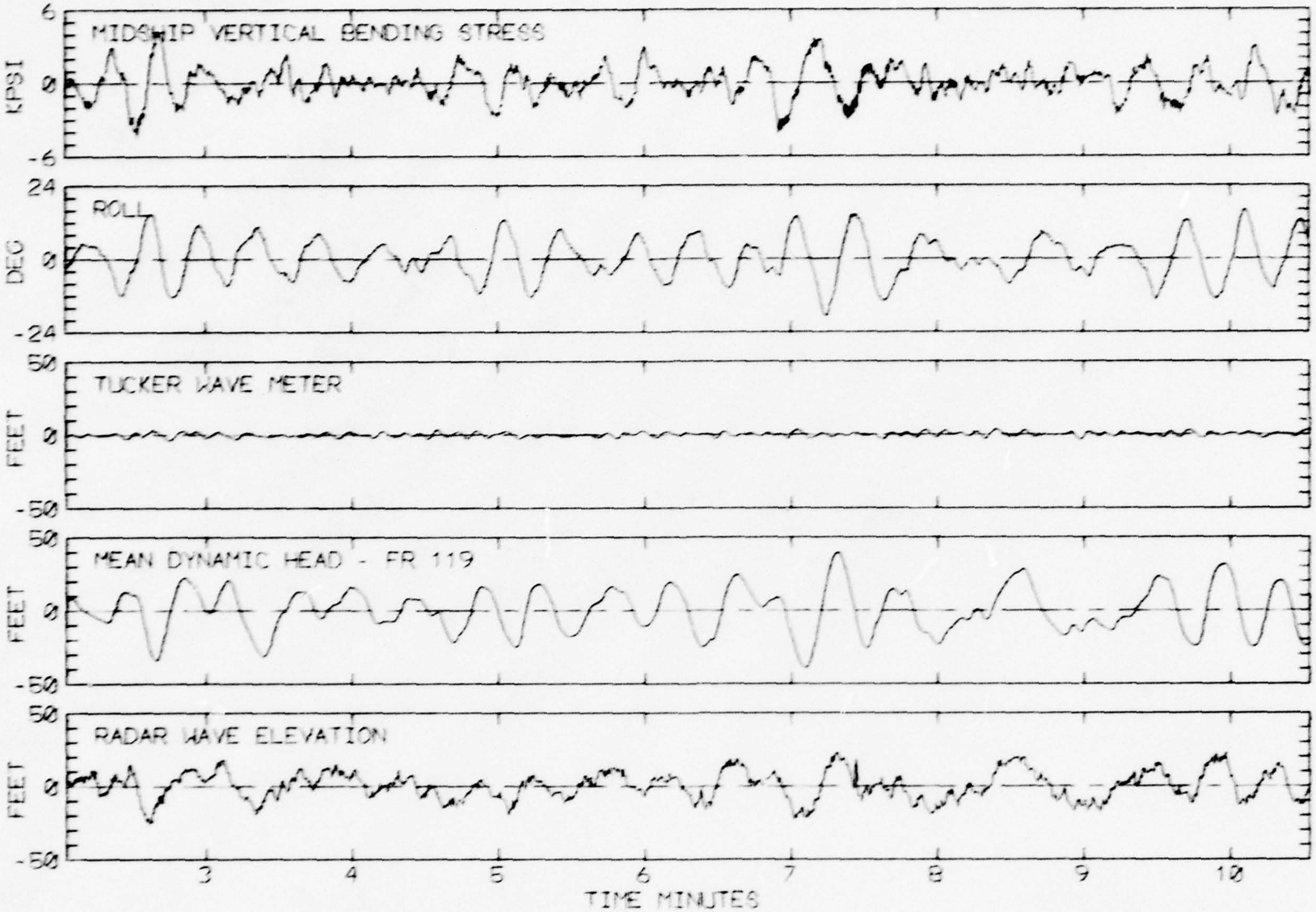
SUMMARY OF MOTIONS (4.0 X RMS)	
ROLL	24.5 DEG
PITCH	0.94 DEG
DK HSE VERT ACCEL	0.29 G
DK HSE LAT ACCEL	0.44 G
RADAR SLANT RANGE	40.8 FEET
VERTICAL RANGE	33.0 FEET
DISPL AT RADAR	55.5 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	205	35	122
MAXIMUM HEIGHT	6.3	64.8	40.1
10TH HIGHEST HTS	4.9	58.8	30.3
3RD HIGHEST HTS	3.6	49.4	21.2
4.0 RMS(SPECTRA)	4.9	55.4	35.2



RUN 2547 -- VOYAGE 61E -- TAPE 223 -- INDEX 12 -- INTERVAL 47



RUN 2547 -- VOYAGE 61E -- TAPE 223 -- INDEX 12 -- INTERVAL 47

LOG BOOK DATA	
DATE AND TIME	03-02-75 2000
POSITION	40-26 N 49-37 W
COURSE AND SPEED	076 , 28.7 KNOTS
SEA STATE	3
WAVE HEIGHT	4 FEET
" REL DIR	149 STBD
SWELL HEIGHT	6 FEET
" REL DIR	149 STBD

---- VISUAL WEATHER / COMMENTS ----

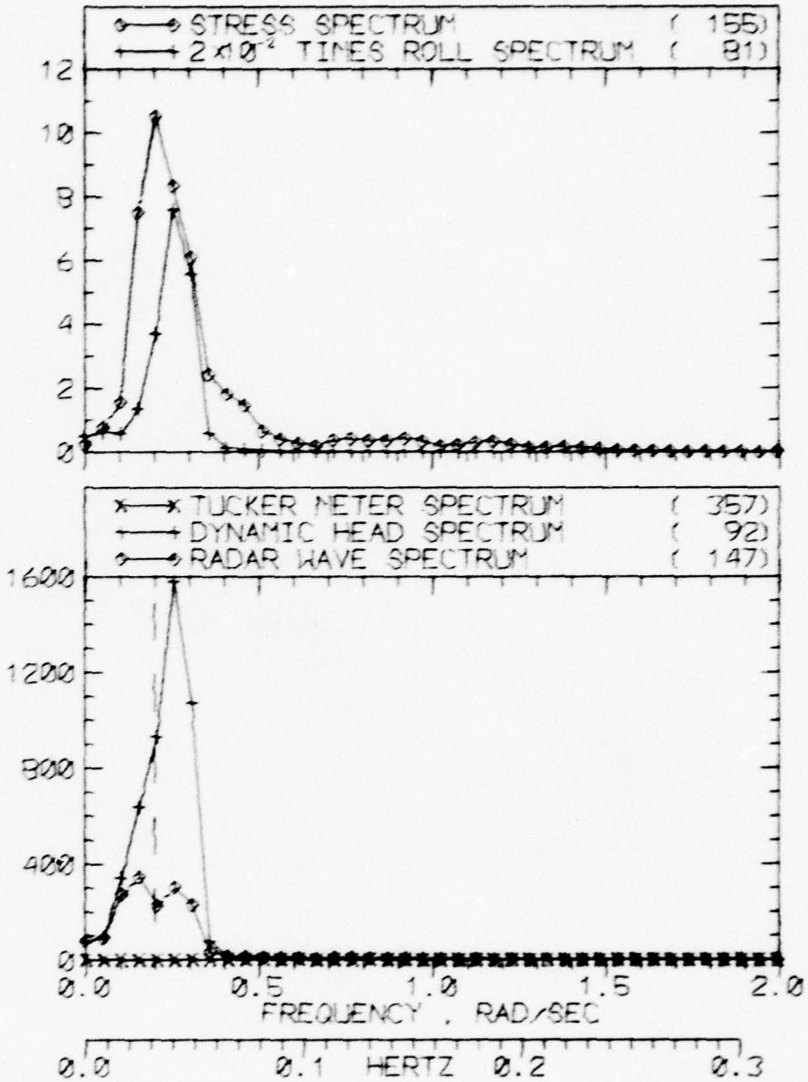
OCAST /

MIDSHIP VERTICAL BENDING STRESS	
MAXIMUM PK-TR	11.4 KPSI
4.0 X RMS	6.2 KPSI

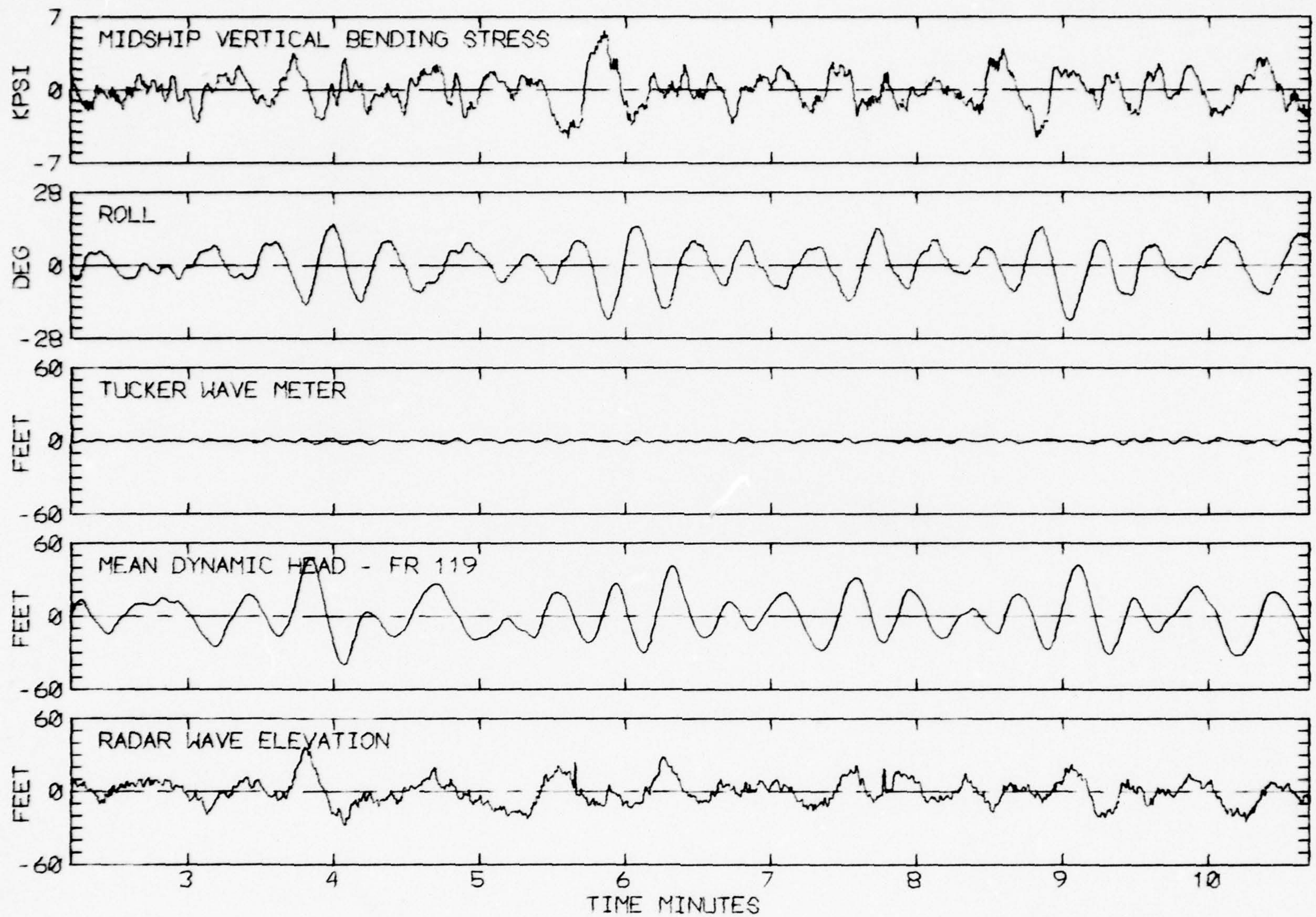
SUMMARY OF MOTIONS (4.0 X RMS)	
ROLL	29.1 DEG
PITCH	0.94 DEG
DK HSE VERT ACCEL	0.28 G
DK HSE LAT ACCEL	0.50 G
RADAR SLANT RANGE	51.6 FEET
VERTICAL RANGE	40.8 FEET
DISPL AT RADAR	61.8 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/	DYN. HEAD/	RADAR
P-T SAMPLE SIZE	269	37	125
MAXIMUM HEIGHT	5.3	86.1	43.5
10TH HIGHEST HTS	3.7	69.0	32.5
3RD HIGHEST HTS	2.5	59.1	21.9
4.0 RMS(SPECTRA)	4.0	62.8	37.7



RUN 2551 -- VOYAGE 61E -- TAPE 223 -- INDEX 13 -- INTERVAL 51



RUN 2551 -- VOYAGE 61E -- TAPE 223 -- INDEX 13 -- INTERVAL 51

LOG BOOK DATA	
DATE AND TIME	03-02-75 2400
POSITION	40-26 N 49-37 W
COURSE AND SPEED	076 , 29.1 KNOTS
SEA STATE	4
WAVE HEIGHT	4 FEET
" REL DIR	177 PORT
SWELL HEIGHT	6 FEET
" REL DIR	149 STBD

---- VISUAL WEATHER / COMMENTS ----

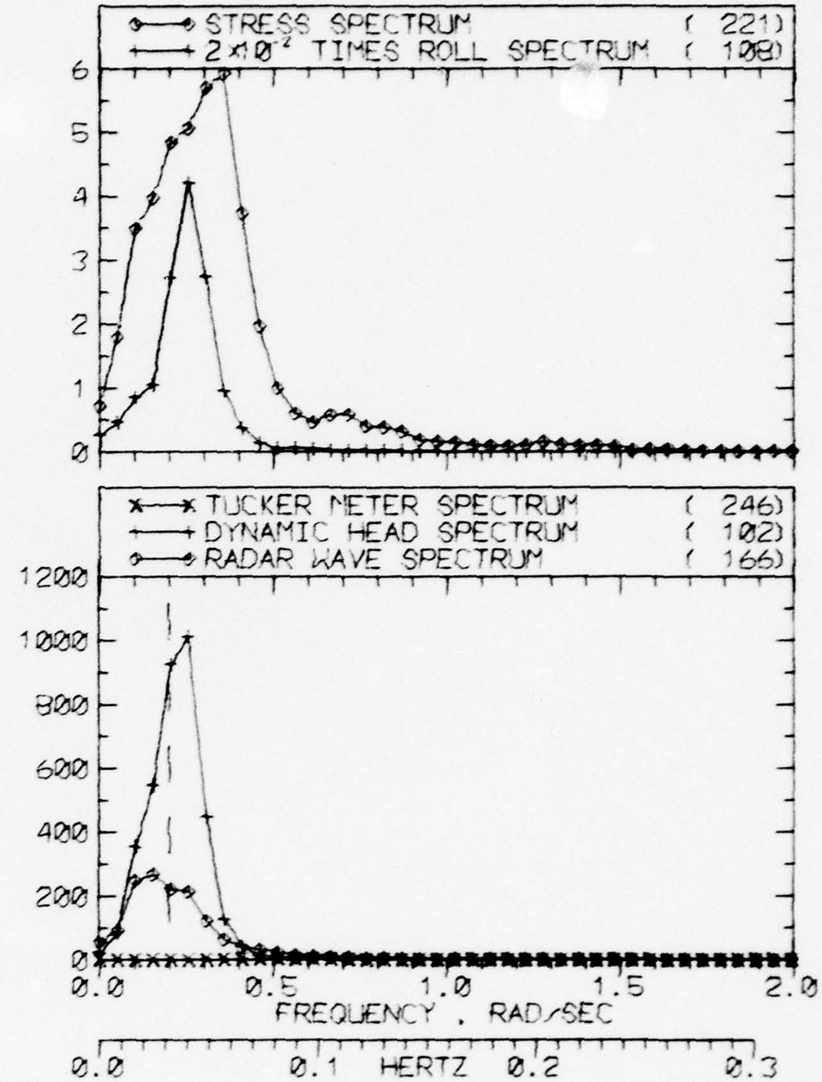
OCAST /

MIDSHIP VERTICAL BENDING STRESS	
MAXIMUM PK-TR	8.1 KPSI
4.0 X RMS	5.9 KPSI

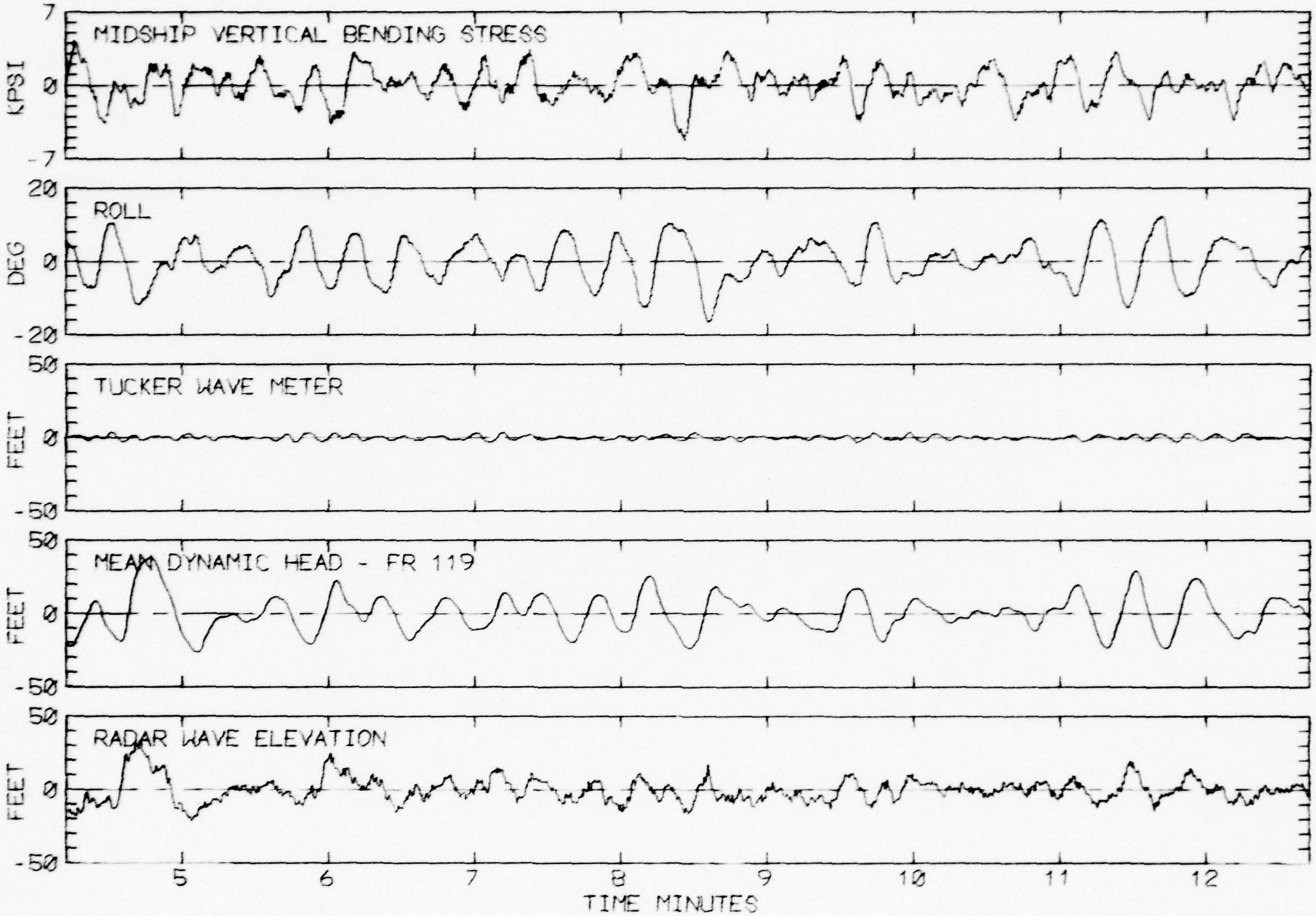
SUMMARY OF MOTIONS (4.0 X RMS)	
ROLL	23.9 DEG
PITCH	0.90 DEG
DK HSE VERT ACCEL	0.28 G
DK HSE LAT ACCEL	0.44 G
RADAR SLANT RANGE	43.9 FEET
VERTICAL RANGE	32.6 FEET
DISPL AT RADAR	54.1 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	233	37	161
MAXIMUM HEIGHT	7.0	78.6	53.5
10TH HIGHEST HTS	4.5	61.3	28.7
3RD HIGHEST HTS	3.0	50.3	17.9
4.0 RMS(SPECTRA)	4.6	54.3	34.7



RUN 2553 -- VOYAGE 61E -- TAPE 223 -- INDEX 14 -- INTERVAL 53



RUN 2553 -- VOYAGE 61E -- TAPE 223 -- INDEX 14 -- INTERVAL 53

LOG BOOK DATA

DATE AND TIME	03-03-75 0400
POSITION	40-26 N 49-37 W
COURSE AND SPEED	090 , 29.1 KNOTS
SEA STATE	4
WAVE HEIGHT	3 FEET
" REL DIR	169 STBD
SWELL HEIGHT	6 FEET
" REL DIR	149 STBD

---- VISUAL WEATHER / COMMENTS ----

PT CLDY /

MIDSHIP VERTICAL BENDING STRESS

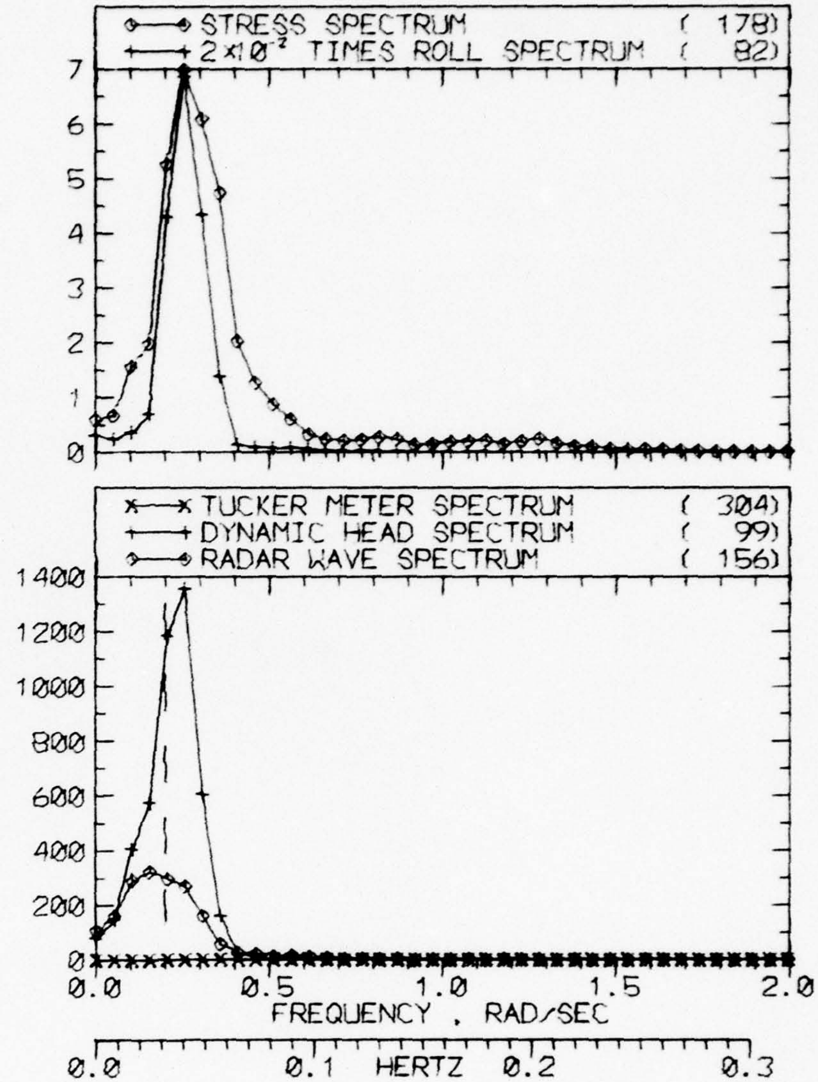
MAXIMUM PK-TR	7.4 KPSI
4.0 X RMS	5.5 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

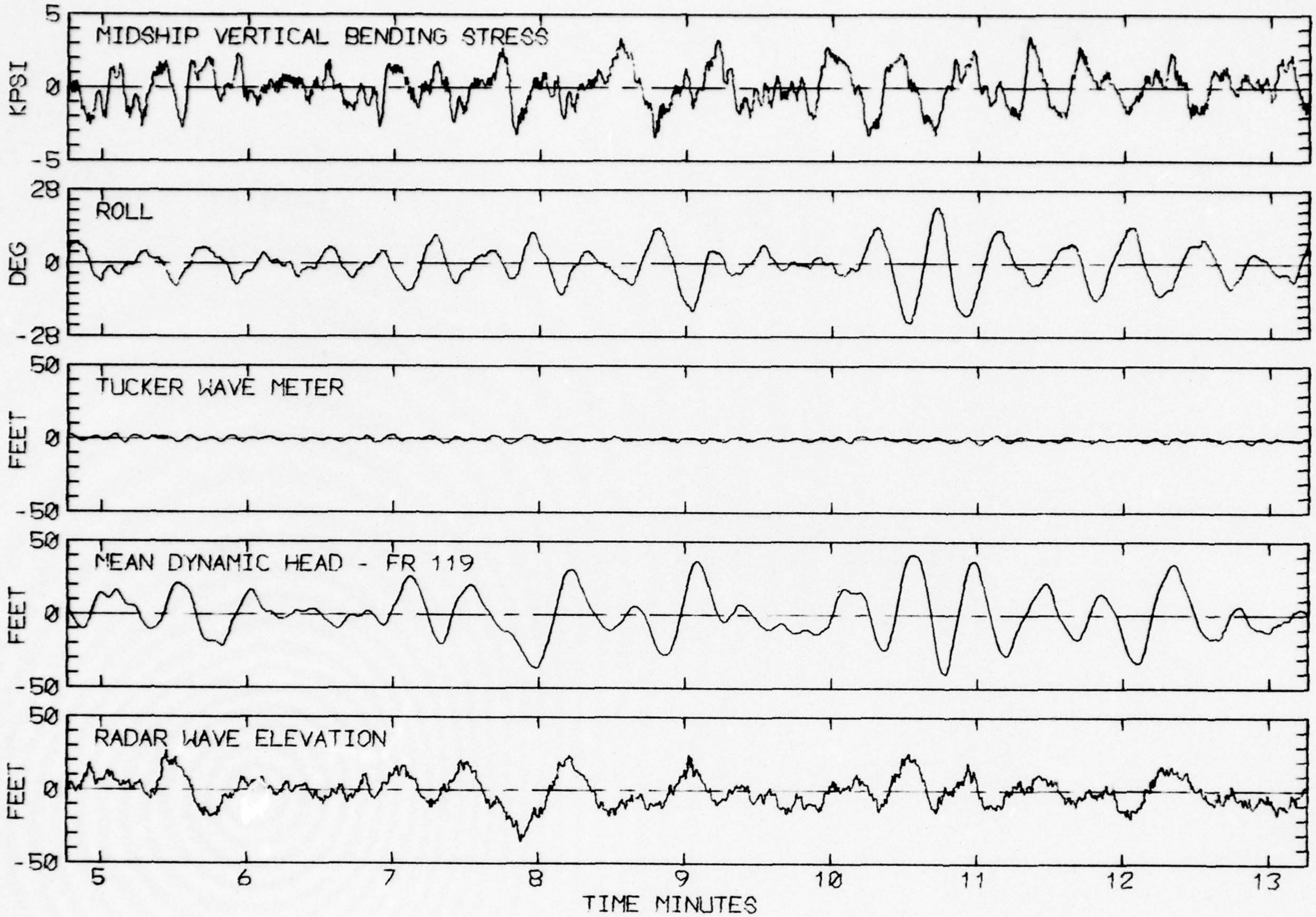
ROLL	27.8 DEG
PITCH	0.94 DEG
DK HSE VERT ACCEL	0.29 G
DK HSE LAT ACCEL	0.51 G
RADAR SLANT RANGE	47.5 FEET
VERTICAL RANGE	35.8 FEET
DISPL AT RADAR	60.1 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	223	37	135
MAXIMUM HEIGHT	6.7	81.0	55.6
10TH HIGHEST HTS	4.6	63.9	33.2
3RD HIGHEST HTS	3.0	52.6	21.4
4.0 RMS(SPECTRA)	4.6	60.9	38.3



RUN 2557 -- VOYAGE 61E -- TAPE 223 -- INDEX 15 -- INTERVAL 57



RUN 2557 -- VOYAGE 61E -- TAPE 223 -- INDEX 15 -- INTERVAL 57

LOG BOOK DATA	
DATE AND TIME	03-03-75 0800
POSITION	40-26 N 49-37 W
COURSE AND SPEED	090 . 20.0 KNOTS
SEA STATE	6
WAVE HEIGHT	2 FEET
" REL DIR	157 STBD
SWELL HEIGHT	5 FEET
" REL DIR	157 STBD

---- VISUAL WEATHER / COMMENTS ----

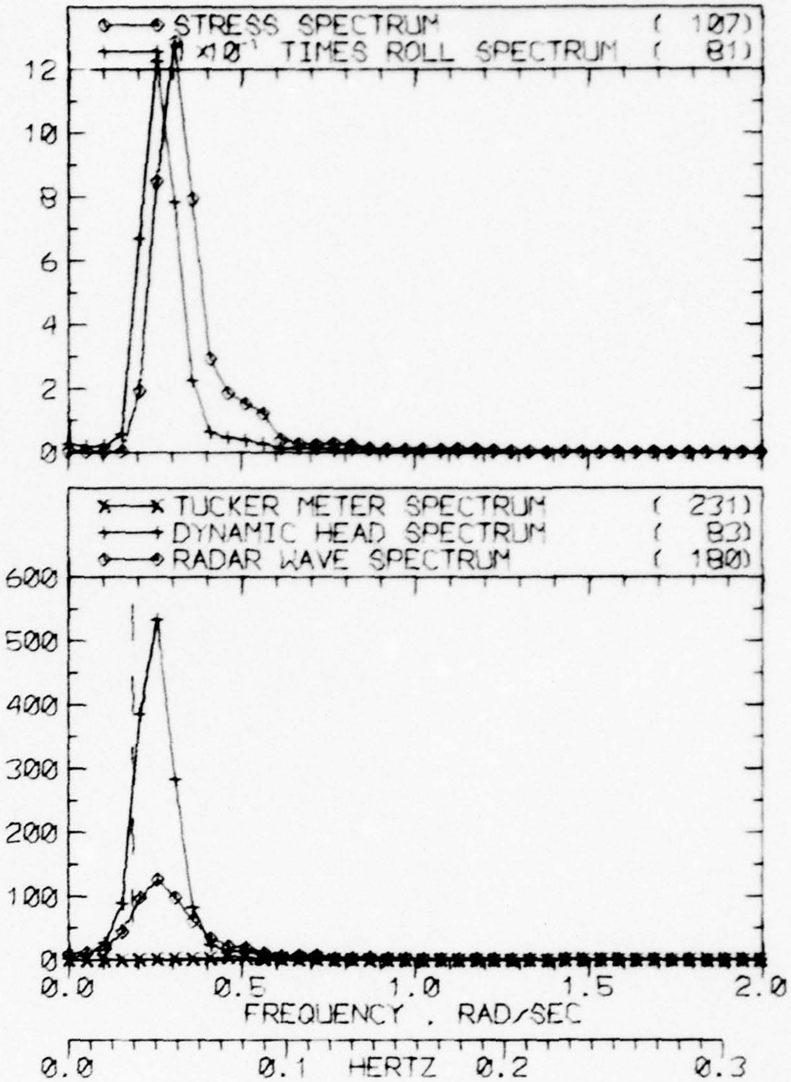
PT CLDY /

MIDSHIP VERTICAL BENDING STRESS	
MAXIMUM PK-TR	8.3 KPSI
4.0 X RMS	5.8 KPSI

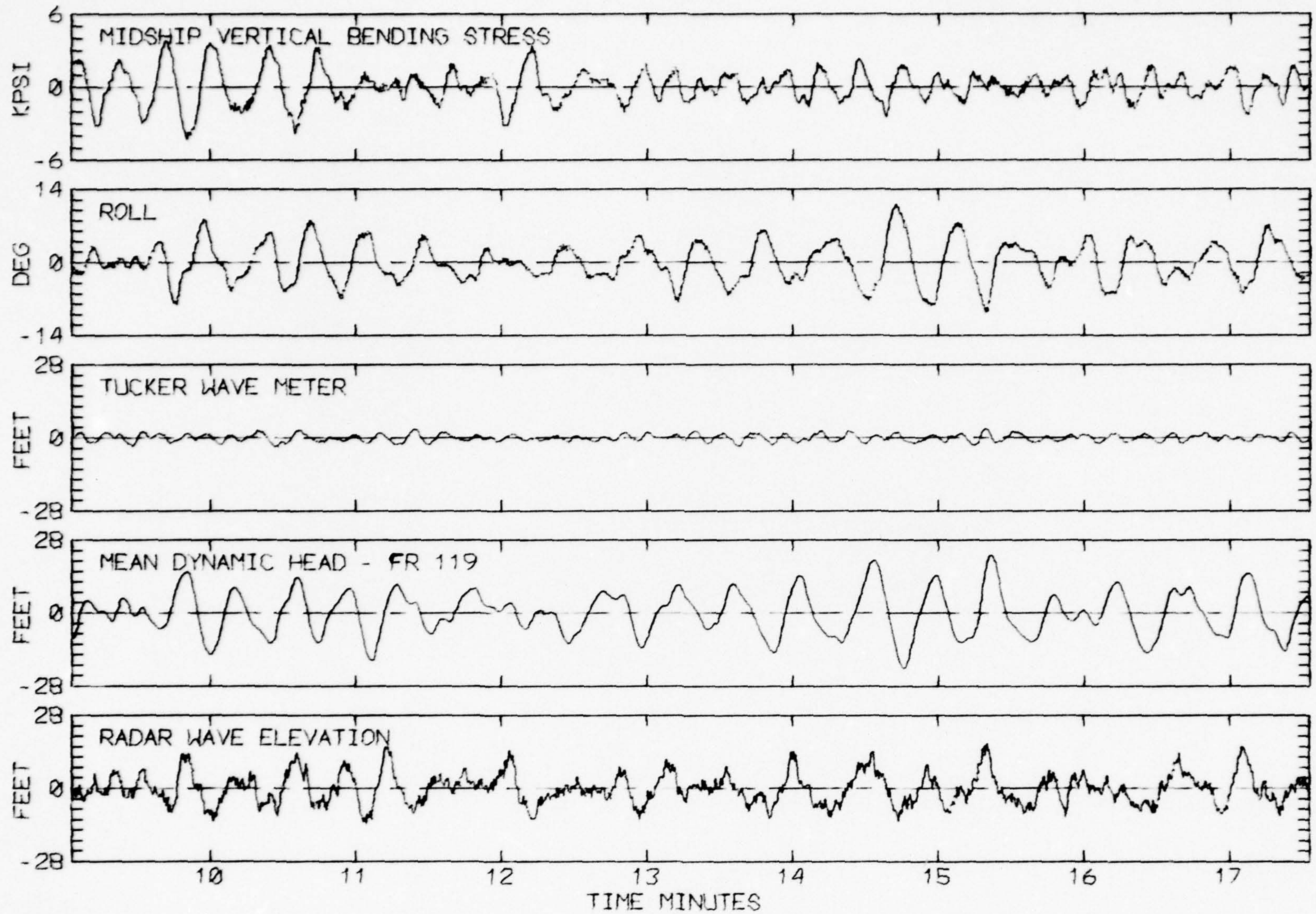
SUMMARY OF MOTIONS (4.0 X RMS)	
ROLL	16.4 DEG
PITCH	0.72 DEG
DK HSE VERT ACCEL	0.22 G
DK HSE LAT ACCEL	0.31 G
RADAR SLANT RANGE	35.1 FEET
VERTICAL RANGE	30.2 FEET
DISPL AT RADAR	36.9 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	188	46	214
MAXIMUM HEIGHT	6.0	41.0	27.6
10TH HIGHEST HTS	4.9	37.3	20.1
3RD HIGHEST HTS	3.4	31.7	12.8
4.0 RMS(SPECTRA)	4.9	34.8	22.7



RUN 2601 -- VOYAGE 61E -- TAPE 225 -- INDEX 16 -- INTERVAL 1



RUN 2601 -- VOYAGE 61E -- TAPE 225 -- INDEX 16 -- INTERVAL 1

LOG BOOK DATA	
DATE AND TIME	03-03-75 1600
POSITION	41-48 N 36-08 W
COURSE AND SPEED	090 . 19.7 KNOTS
SEA STATE	3
WAVE HEIGHT	1 FEET
" REL DIR	180
SWELL HEIGHT	4 FEET
" REL DIR	146 STBD

---- VISUAL WEATHER / COMMENTS ----

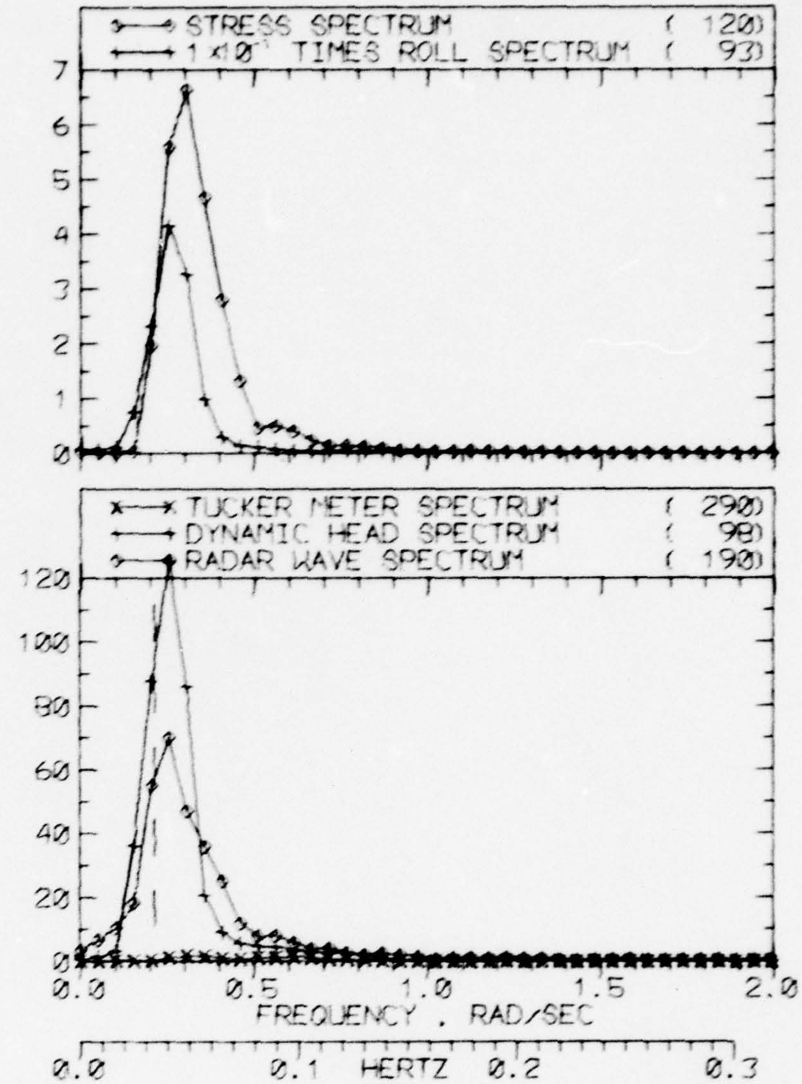
CLEAR /

MIDSHIP VERTICAL BENDING STRESS	
MAXIMUM PK-TR	7.5 KPSI
4.0 X RMS	4.6 KPSI

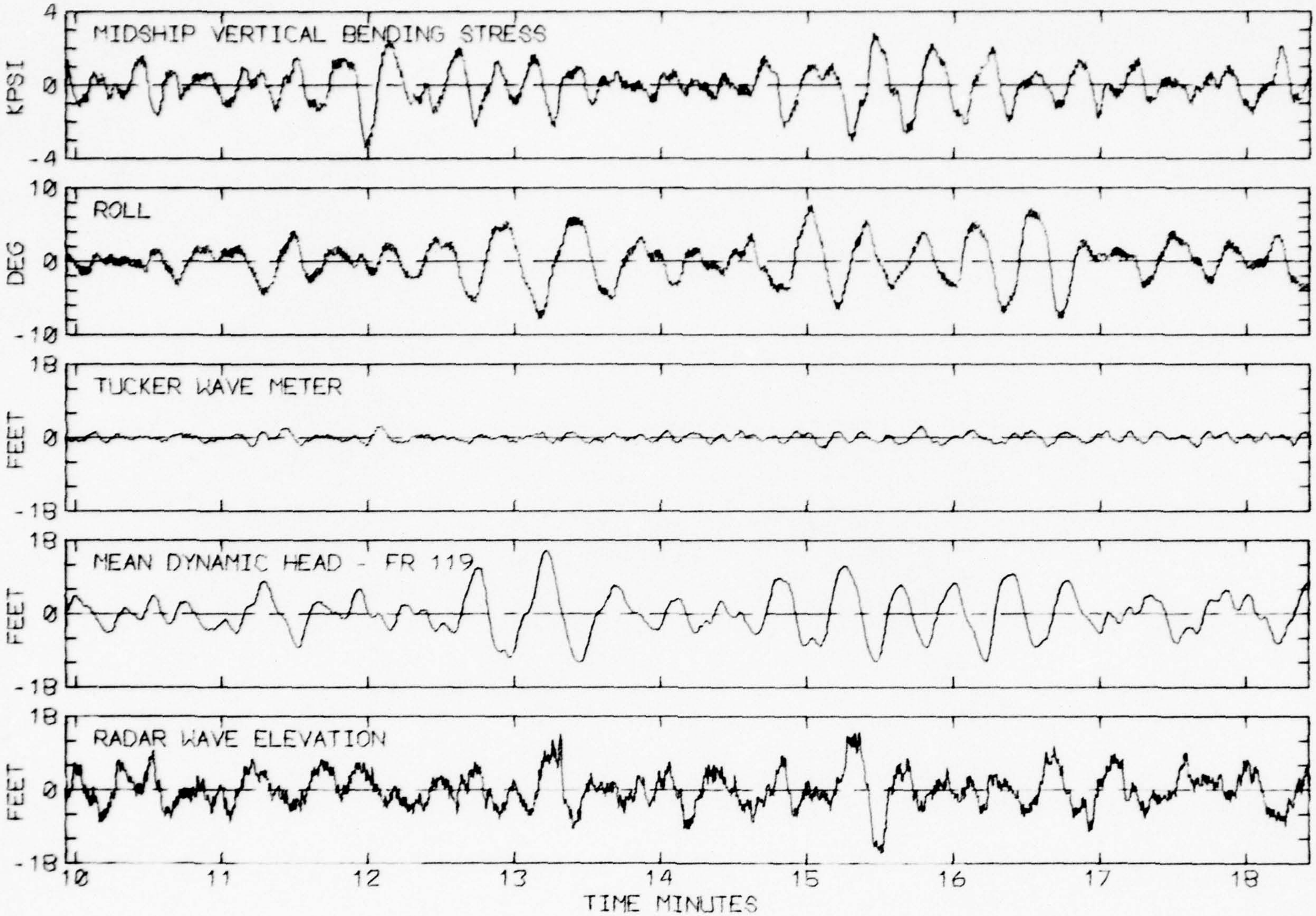
SUMMARY OF MOTIONS (4.0 X RMS)	
ROLL	10.2 DEG
PITCH	0.66 DEG
DK HSE VERT ACCEL	0.20 G
DK HSE LAT ACCEL	0.20 G
RADAR SLANT RANGE	24.9 FEET
VERTICAL RANGE	21.7 FEET
DISPL AT RADAR	20.5 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/	DYN. HEAD/	RADAR
P-T SAMPLE SIZE	285	68	263
MAXIMUM HEIGHT	4.9	27.2	30.4
10TH HIGHEST HTS	3.1	20.6	14.0
3RD HIGHEST HTS	2.0	15.6	8.7
4.0 RMS(SPECTRA)	3.6	18.1	17.0



RUN 2609 -- VOYAGE 61E -- TAPE 225 -- INDEX 18 -- INTERVAL 9



RUN 2609 -- VOYAGE 61E -- TAPE 225 -- INDEX 18 -- INTERVAL 9

LOG BOOK DATA	
DATE AND TIME	03-03-75 2400
POSITION	41-48 N 36-08 W
COURSE AND SPEED	071 . 19.8 KNOTS
SEA STATE	4
WAVE HEIGHT	1 FEET
" REL DIR	159 PORT
SWELL HEIGHT	4 FEET
" REL DIR	159 PORT

---- VISUAL WEATHER / COMMENTS ----

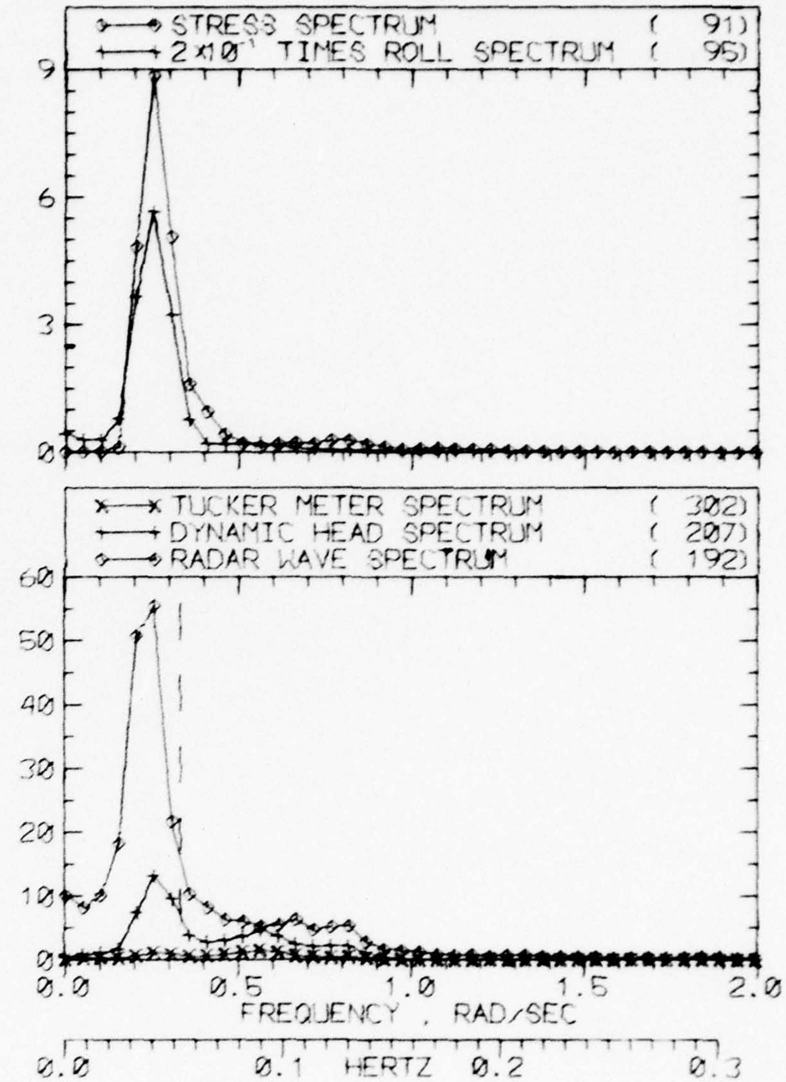
CLEAR /

MIDSHIP VERTICAL BENDING STRESS	
MAXIMUM PK-TR	8.2 KPSI
4.0 X RMS	4.5 KPSI

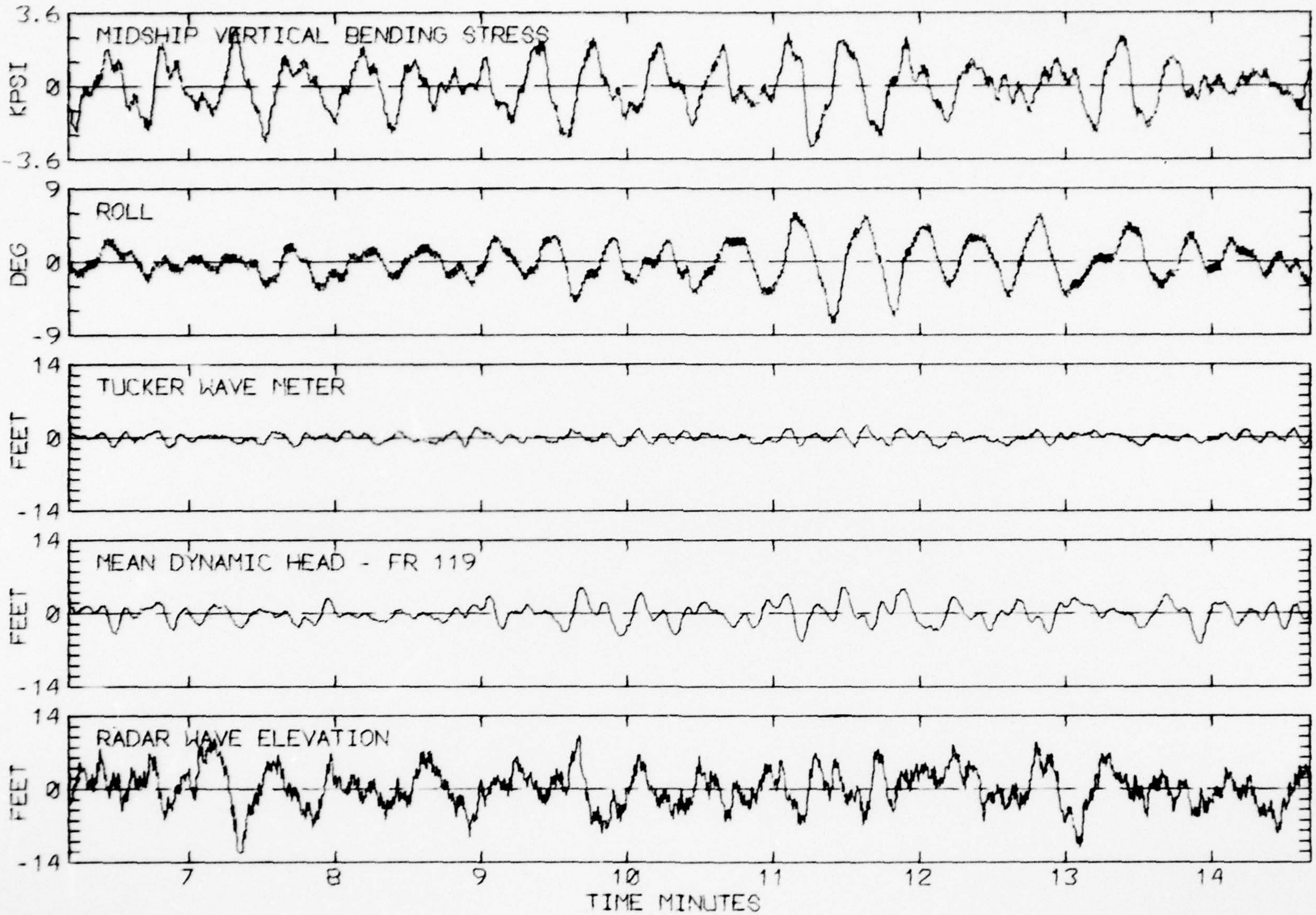
SUMMARY OF MOTIONS (4.0 X RMS)	
ROLL	8.2 DEG
PITCH	0.75 DEG
DK HSE VERT ACCEL	0.20 G
DK HSE LAT ACCEL	0.17 G
RADAR SLANT RANGE	17.6 FEET
VERTICAL RANGE	16.2 FEET
DISPL AT RADAR	11.4 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	333	142	328
MAXIMUM HEIGHT	3.7	9.7	22.9
10TH HIGHEST HTS	2.7	7.2	11.6
3RD HIGHEST HTS	1.8	5.1	7.6
4.0 RMS(SPECTRA)	3.2	7.4	14.6



RUN 2617 -- VOYAGE 61E -- TAPE 225 -- INDEX 20 -- INTERVAL 17



RUN 2617 -- VOYAGE 61E -- TAPE 225 -- INDEX 20 -- INTERVAL 17

LOG BOOK DATA

DATE AND TIME	03-04-75 0800
POSITION	41-48 N 36-08 W
COURSE AND SPEED	071 , 19.6 KNOTS
SEA STATE	4
WAVE HEIGHT	1 FEET
" REL DIR	159 PORT
SWELL HEIGHT	3 FEET
" REL DIR	159 PORT

---- VISUAL WEATHER / COMMENTS ----

OCAST /

MIDSHIP VERTICAL BENDING STRESS

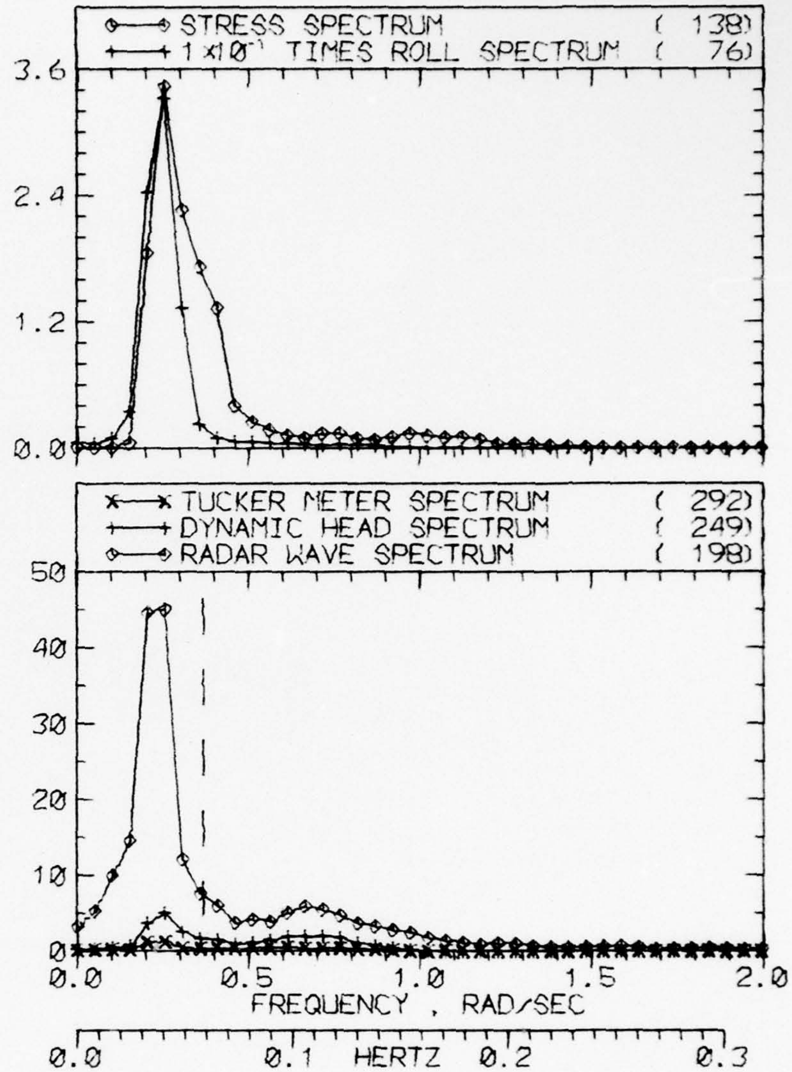
MAXIMUM PK-TR	5.1 KPSI
4.0 X RMS	3.3 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

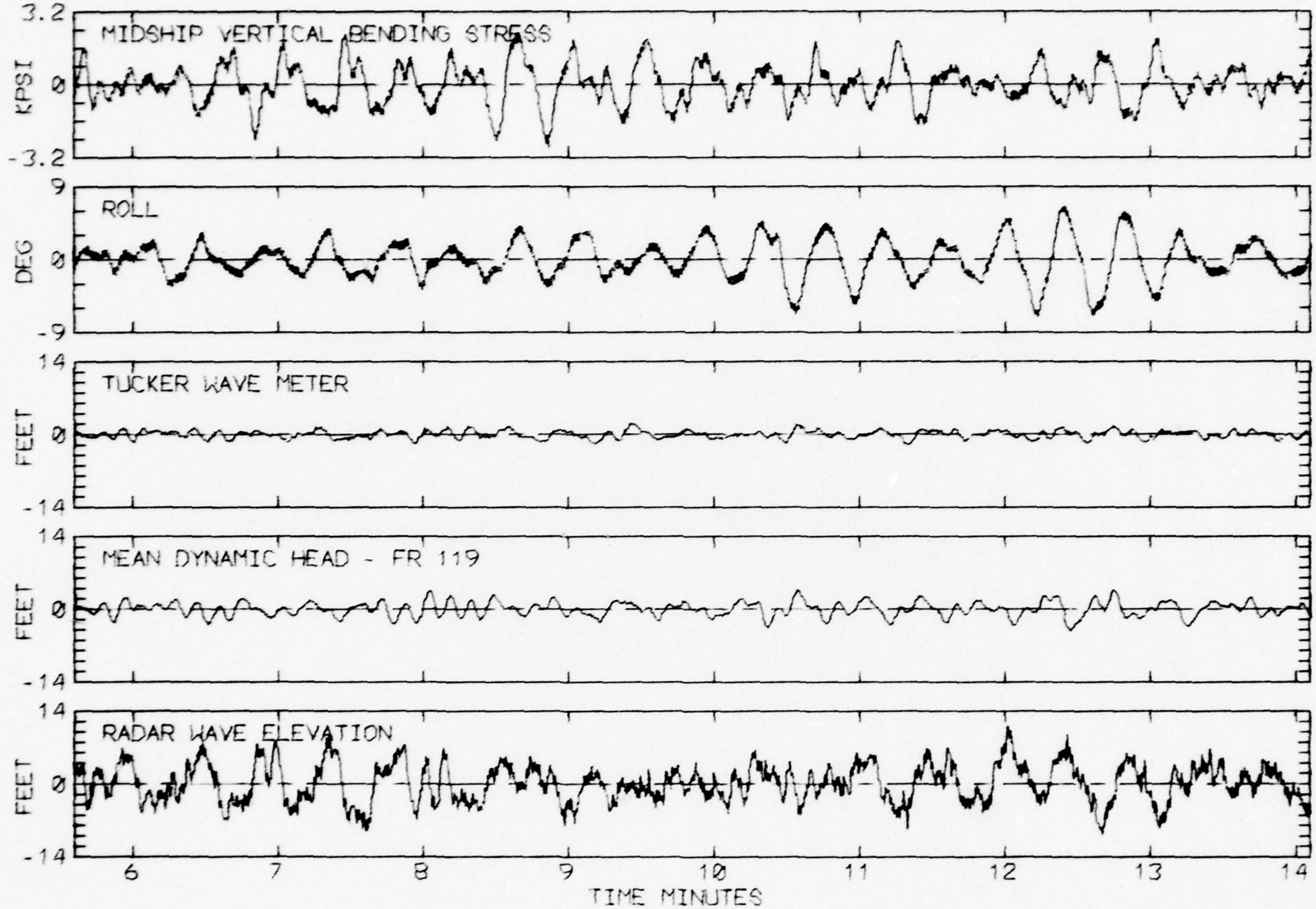
ROLL	8.3 DEG
PITCH	0.75 DEG
DK HSE VERT ACCEL	0.19 G
DK HSE LAT ACCEL	0.17 G
RADAR SLANT RANGE	18.4 FEET
VERTICAL RANGE	15.9 FEET
DISPL AT RADAR	9.3 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	384	175	304
MAXIMUM HEIGHT	2.9	7.0	18.3
10TH HIGHEST HTS	2.1	5.0	9.8
3RD HIGHEST HTS	1.4	3.4	7.3
4.0 RMS(SPECTRA)	2.6	4.9	13.4



RUN 2625 -- VOYAGE 61E -- TAPE 225 -- INDEX 22 -- INTERVAL 25



RUN 2625 -- VOYAGE 61E -- TAPE 225 -- INDEX 22 -- INTERVAL 25

LOG BOOK DATA

DATE AND TIME	03-04-75 1600
POSITION	43-45 N 26-00 W
COURSE AND SPEED	071 , 19.5 KNOTS
SEA STATE	3
WAVE HEIGHT	1 FEET
" REL DIR	159 PORT
SWELL HEIGHT	3 FEET
" REL DIR	159 PORT

---- VISUAL WEATHER / COMMENTS ----

FOG OCAST /

MIDSHIP VERTICAL BENDING STRESS

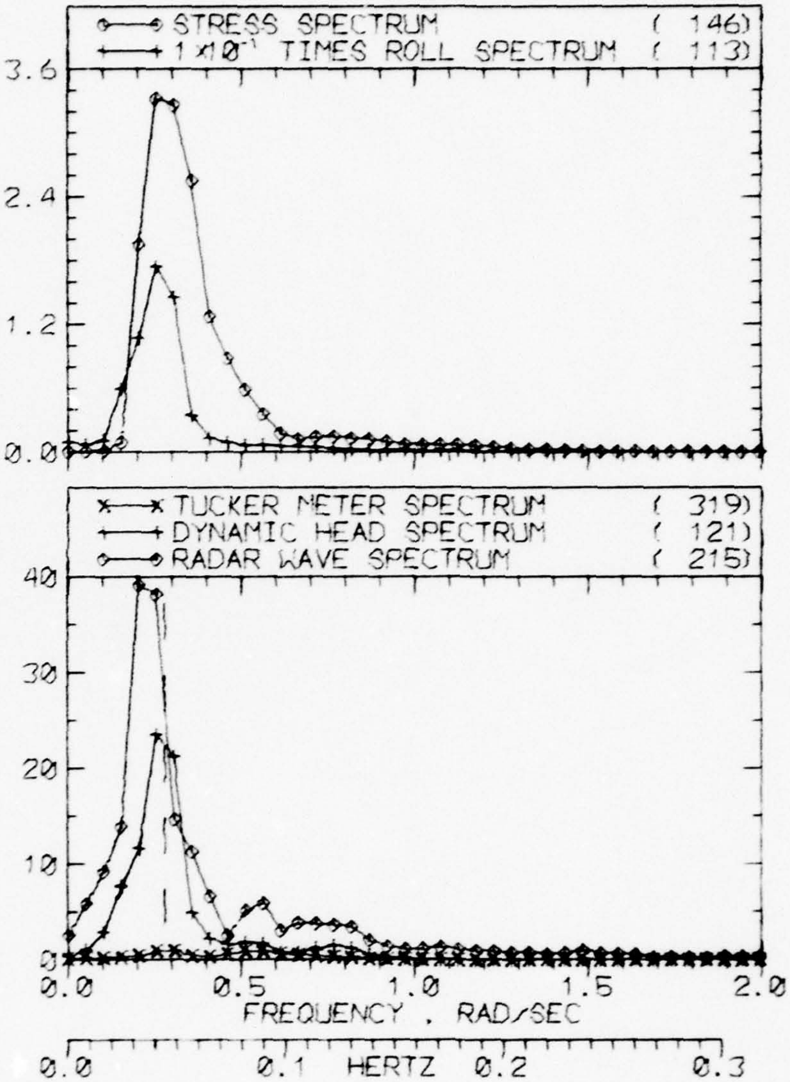
MAXIMUM PK-TR	4.1 KPSI
4.0 X RMS	3.6 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

ROLL	7.1 DEG
PITCH	0.72 DEG
DK HSE VERT ACCEL	0.18 G
DK HSE LAT ACCEL	0.16 G
RADAR SLANT RANGE	17.9 FEET
VERTICAL RANGE	16.1 FEET
DISPL AT RADAR	11.4 FEET

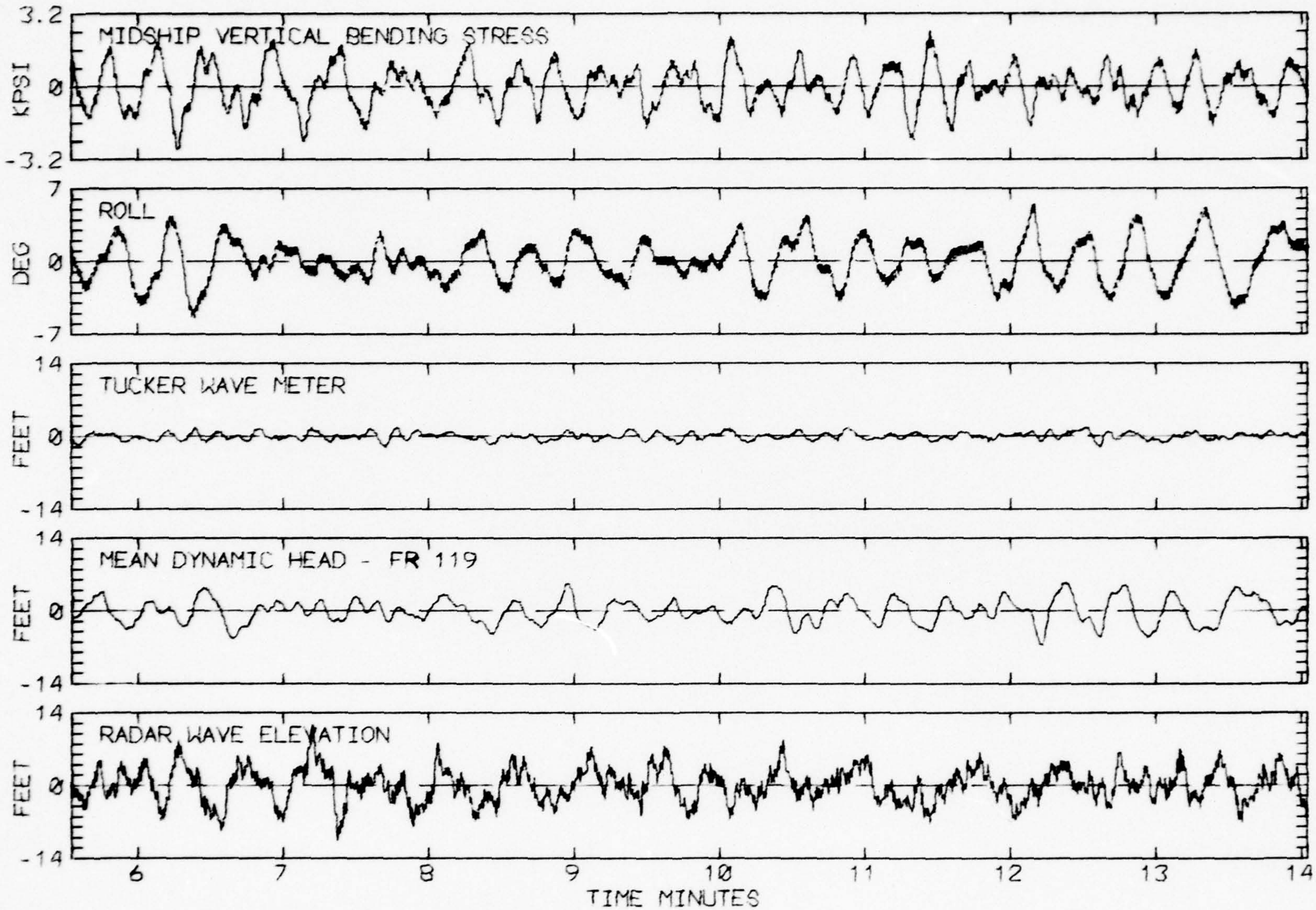
WAVE HEIGHT STATISTICS (FEET)

	TUCKER/	DYN. HEAD/	RADAR
P-T SAMPLE SIZE	363	92	362
MAXIMUM HEIGHT	4.1	10.6	22.2
10TH HIGHEST HTS	2.1	9.0	9.4
3RD HIGHEST HTS	1.4	6.0	6.5
4.0 RMS(SPECTRA)	2.8	8.4	12.9



RUN 2633 -- VOYAGE 61E -- TAPE 225 -- INDEX 24 -- INTERVAL 33

39



RUN 2633 -- VOYAGE 61E -- TAPE 225 -- INDEX 24 -- INTERVAL 33

LOG BOOK DATA

DATE AND TIME	03-04-75 2400
POSITION	43-45 N 26-00 W
COURSE AND SPEED	071 , 19.5 KNOTS
SEA STATE	3
WAVE HEIGHT	1 FEET
" REL DIR	159 PORT
SWELL HEIGHT	3 FEET
" REL DIR	159 PORT

---- VISUAL WEATHER / COMMENTS ----

FOG RAIN /

MIDSHIP VERTICAL BENDING STRESS

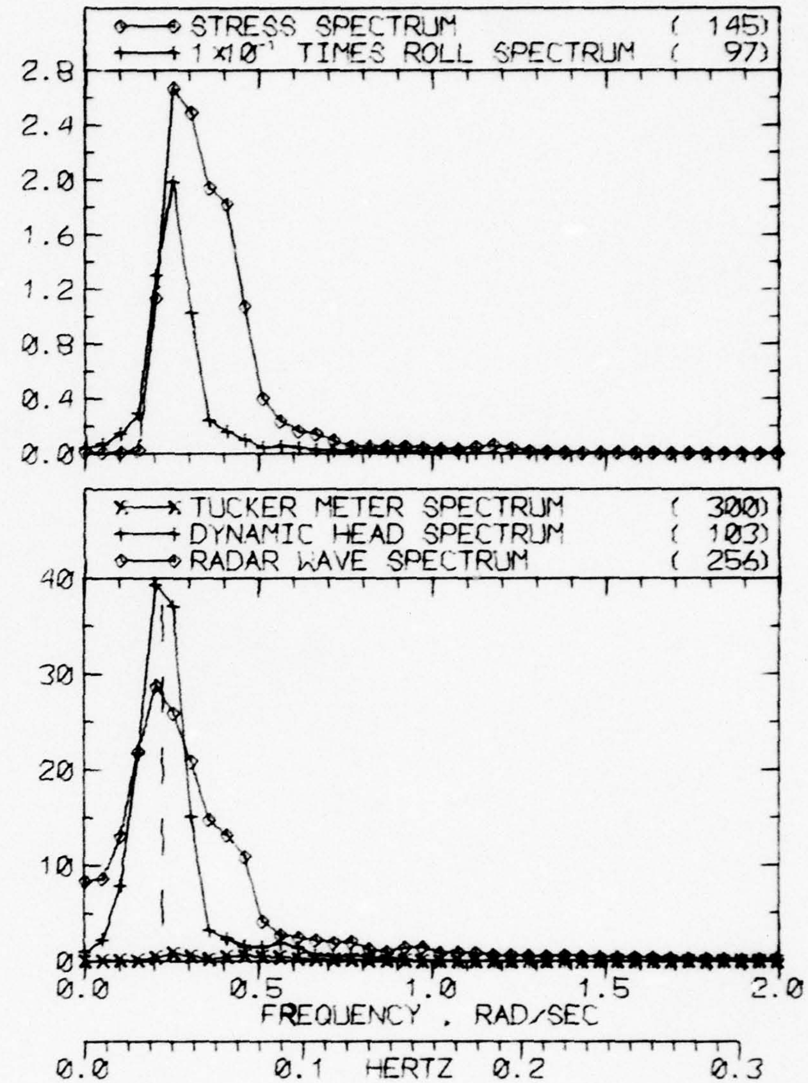
MAXIMUM PK-TR	5.7 KPSI
4.0 X RMS	3.3 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

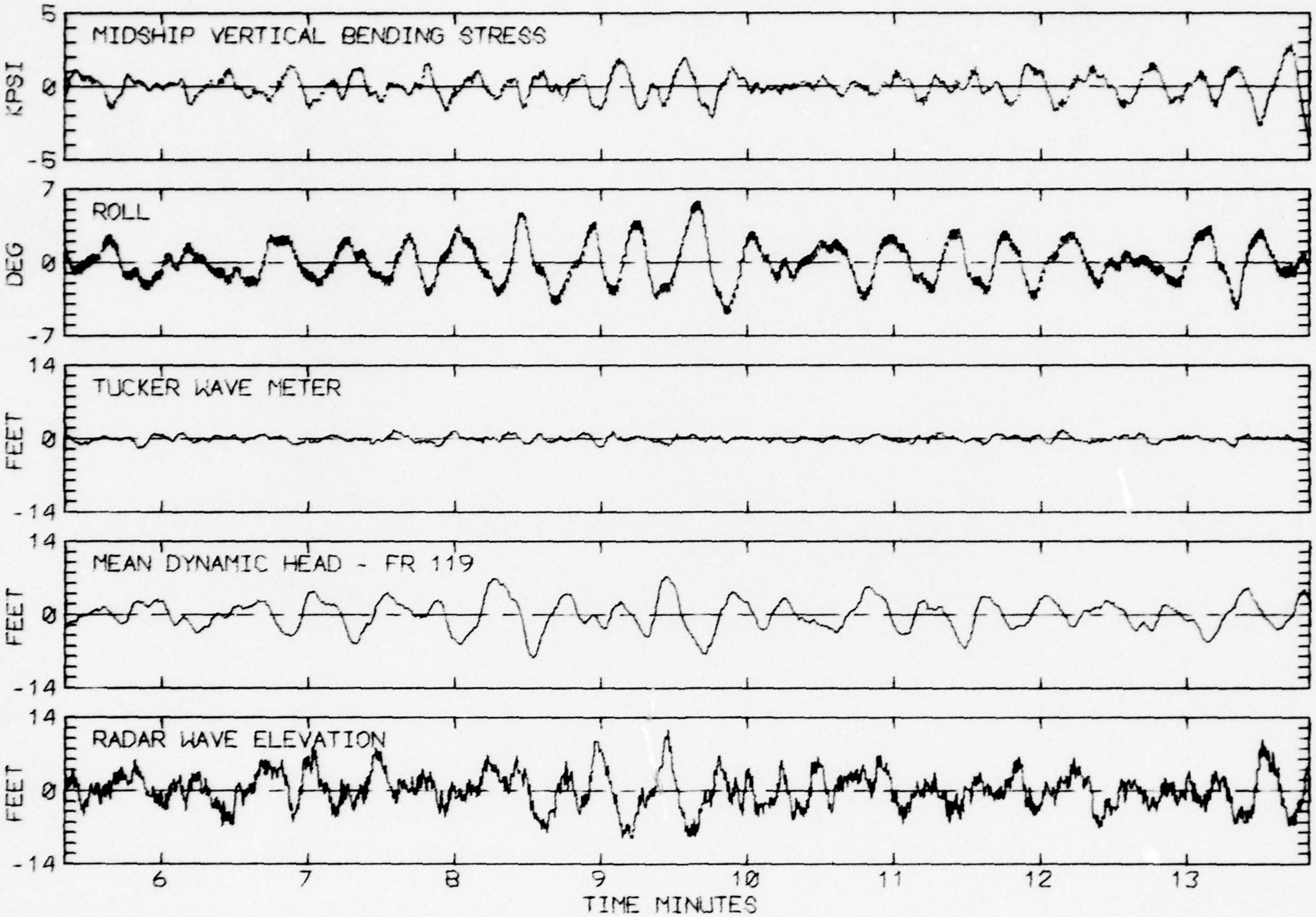
ROLL	6.9 DEG
PITCH	0.69 DEG
DK HSE VERT ACCEL	0.15 G
DK HSE LAT ACCEL	0.15 G
RADAR SLANT RANGE	16.5 FEET
VERTICAL RANGE	15.0 FEET
DISPL AT RADAR	12.5 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER	/DYN. HEAD	/RADAR
P-T SAMPLE SIZE	556	71	352
MAXIMUM HEIGHT	2.9	15.3	13.4
10TH HIGHEST HTS	1.5	11.6	8.8
3RD HIGHEST HTS	1.0	8.4	5.9
4.0 RMS(SPECTRA)	2.3	10.7	12.9



RUN 2641 -- VOYAGE 61E -- TAPE 225 -- INDEX 26 -- INTERVAL 41



RUN 2641 -- VOYAGE 61E -- TAPE 225 -- INDEX 26 -- INTERVAL 41

LOG BOOK DATA

DATE AND TIME	03-05-75 0800
POSITION	43-45 N 26-00 W
COURSE AND SPEED	071 , 19.5 KNOTS
SEA STATE	2
WAVE HEIGHT	1 FEET
" REL DIR	159 PORT
SWELL HEIGHT	2 FEET
" REL DIR	159 PORT

---- VISUAL WEATHER / COMMENTS ----

FOG RAIN /

MIDSHIP VERTICAL BENDING STRESS

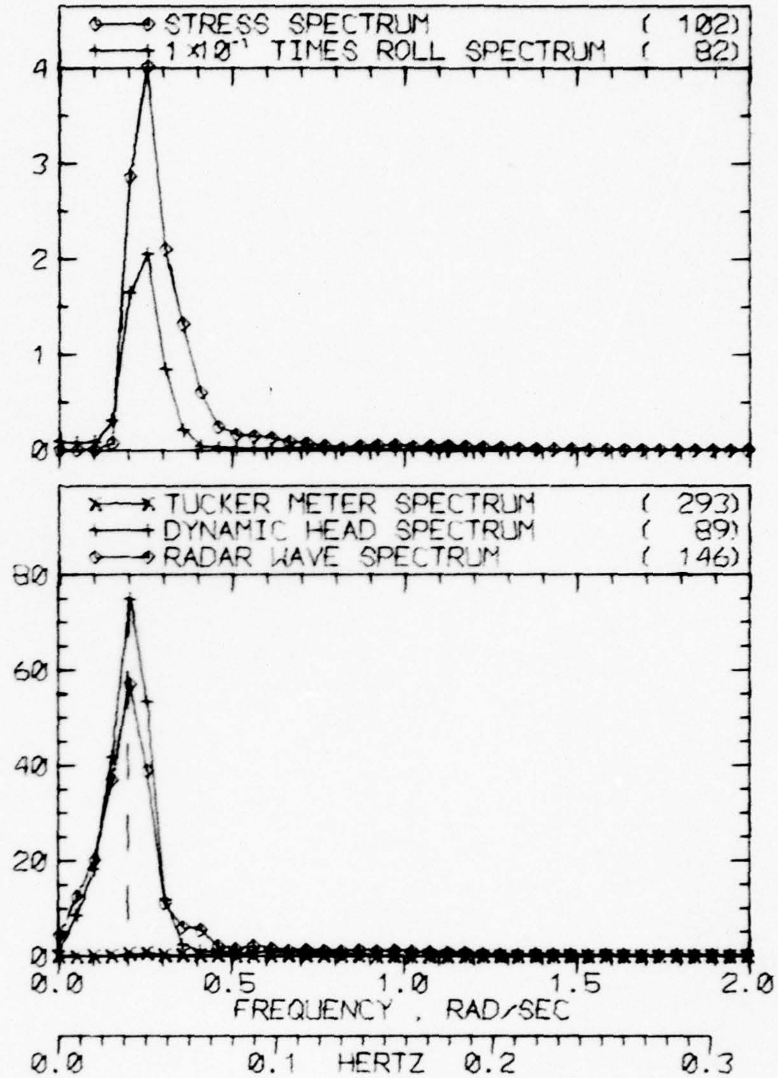
MAXIMUM PK-TR	4.8 KPSI
4.0 X RMS	3.2 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

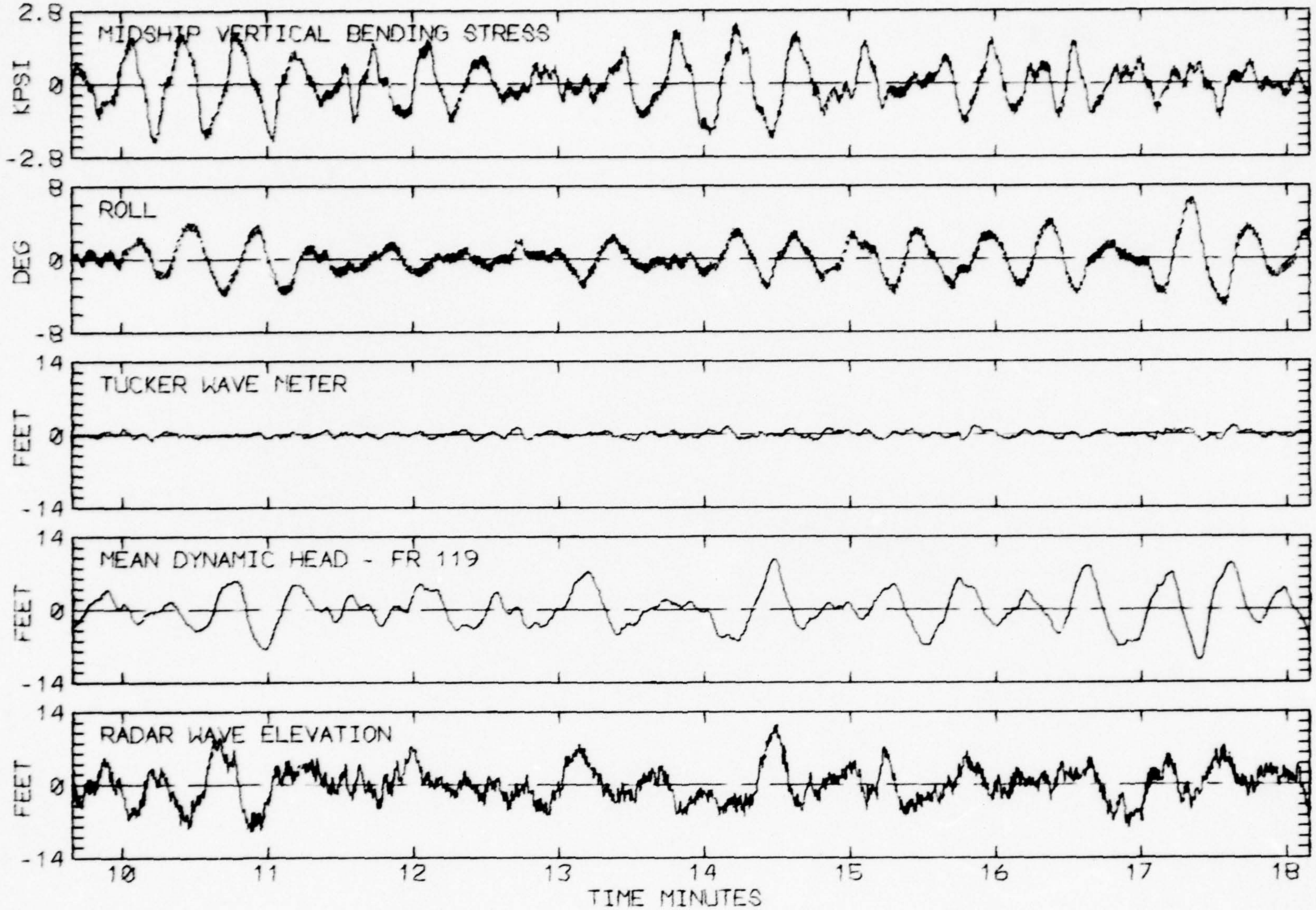
ROLL	6.8 DEG
PITCH	0.68 DEG
DK HSE VERT ACCEL	0.15 G
DK HSE LAT ACCEL	0.14 G
RADAR SLANT RANGE	13.3 FEET
VERTICAL RANGE	11.9 FEET
DISPL AT RADAR	14.0 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	557	64	303
MAXIMUM HEIGHT	2.0	17.0	18.9
10TH HIGHEST HTS	1.2	13.8	9.8
3RD HIGHEST HTS	0.8	10.0	6.1
4.0 RMS(SPECTRA)	1.9	13.4	13.6



RUN 2649 -- VOYAGE 61E -- TAPE 225 -- INDEX 28 -- INTERVAL 49



RUN 2649 -- VOYAGE 61E -- TAPE 225 -- INDEX 28 -- INTERVAL 49

LOG BOOK DATA	
DATE AND TIME	03-05-75 1600
POSITION	46-12 N 15-42 W
COURSE AND SPEED	071 . 19.4 KNOTS
SEA STATE	4
WAVE HEIGHT	2 FEET
" REL DIR	131 STBD
SWELL HEIGHT	2 FEET
" REL DIR	131 STBD

---- VISUAL WEATHER / COMMENTS ----

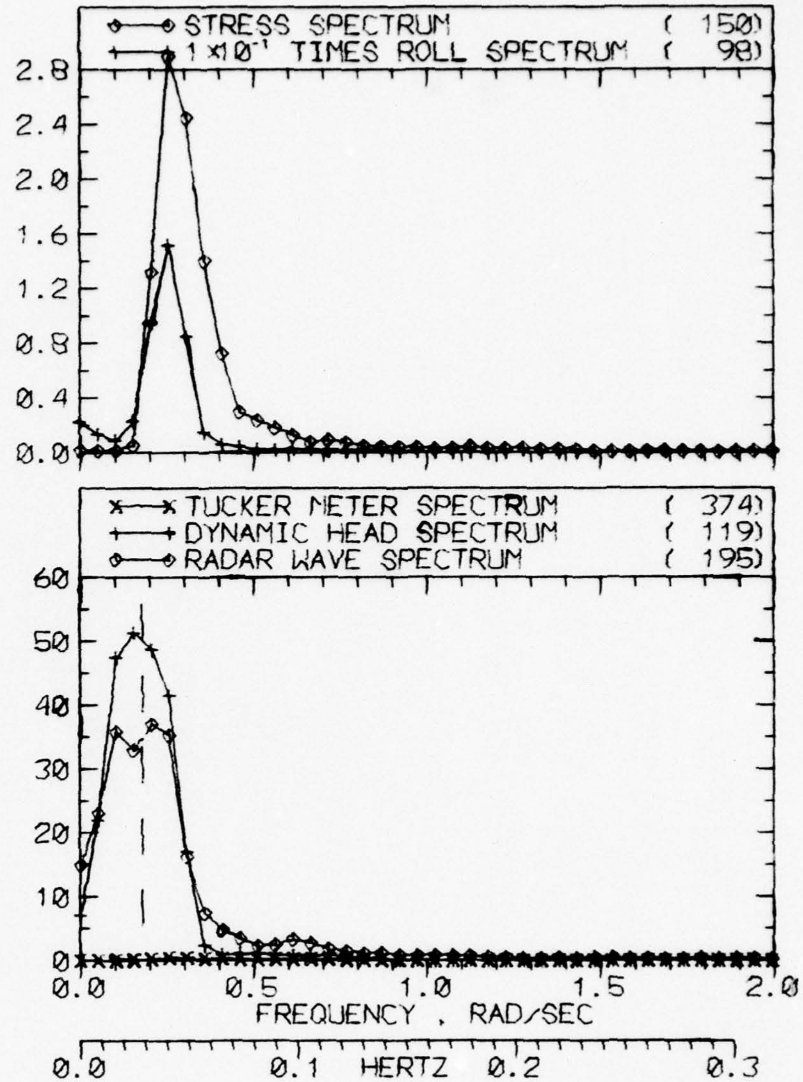
FOG RAIN /

MIDSHIP VERTICAL BENDING STRESS	
MAXIMUM PK-TR	5.0 KPSI
4.0 X RMS	3.1 KPSI

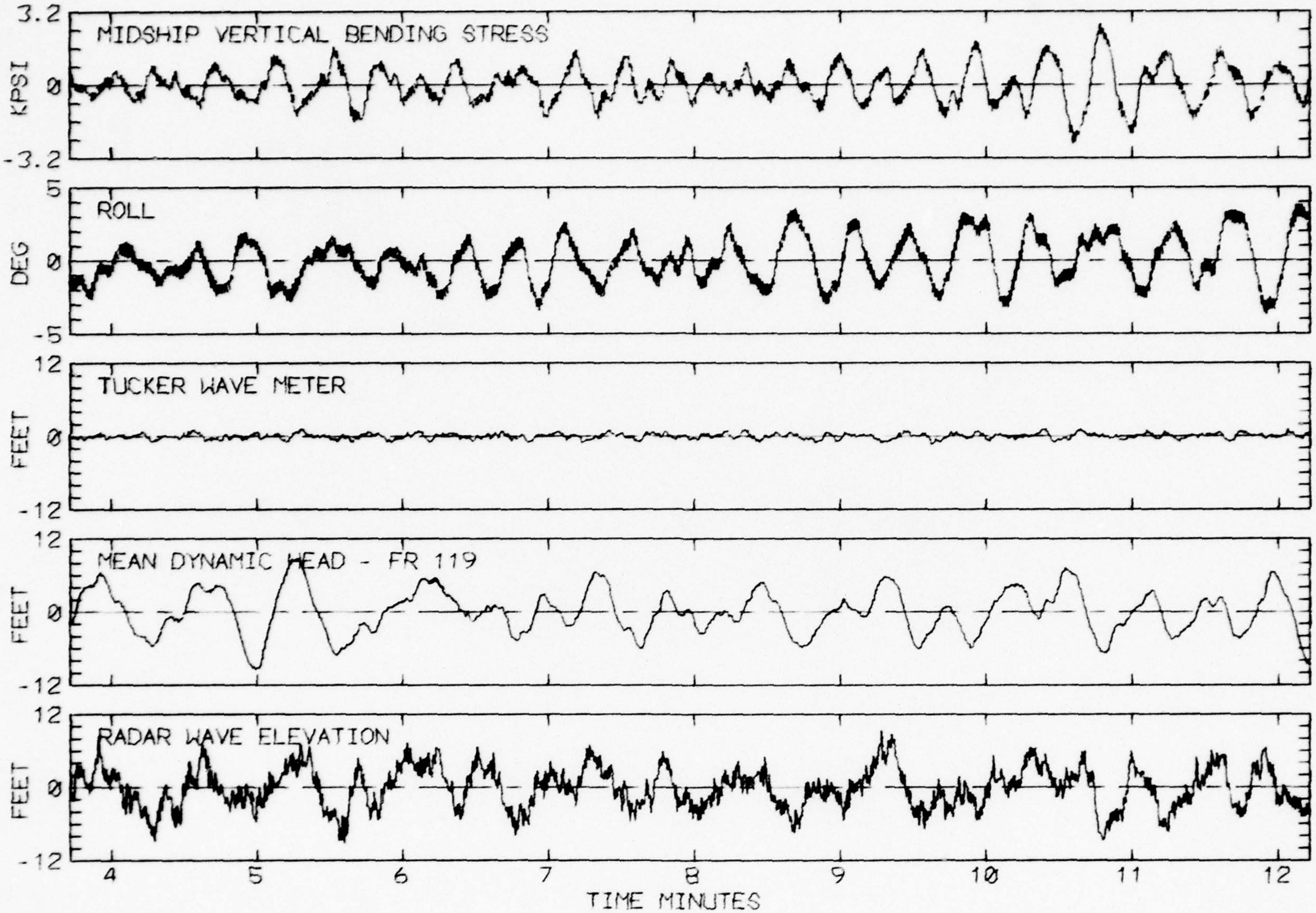
SUMMARY OF MOTIONS (4.0 X RMS)	
ROLL	6.0 DEG
PITCH	0.66 DEG
DK HSE VERT ACCEL	0.14 G
DK HSE LAT ACCEL	0.14 G
RADAR SLANT RANGE	13.2 FEET
VERTICAL RANGE	11.6 FEET
DISPL AT RADAR	14.1 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	571	55	301
MAXIMUM HEIGHT	1.6	16.1	15.6
10TH HIGHEST HTS	1.2	14.8	9.1
3RD HIGHEST HTS	0.9	10.6	6.4
4.0 RMS(SPECTRA)	1.9	14.1	14.1



RUN 2657 -- VOYAGE 61E -- TAPE 225 -- INDEX 30 -- INTERVAL 57



RUN 2657 -- VOYAGE 61E -- TAPE 225 -- INDEX 30 -- INTERVAL 57

TABLE IIa

SUMMARY OF TMR LOG-BOOK DATA CORRESPONDING TO
INTERVALS SELECTED FOR WAVE METER DATA REDUCTION (PAGE 1 OF 2)

SEA LAND MC LEAN : 1974-1975 WINTER SEASON : VOYAGE 61 WEST

D.L. RUN NO.	TMR TAPE NO.	TMR INDX NO.	TMR INTV NO.	DATE	TIME (GMT)	LATITUDE	LONGITUDE	COURSE	SPEED KT.	PROP RPM	DRAFT FT.	SEA/AIR TEMP
2713	229	4	13	03-11-75	2400	50-02 N	00-47 W	244	33.1	133.5		51/48
2725	229	7	25	03-12-75	1200	44-15 N	17-36 W	244	32.2	132.0		52/52
2737	229	10	37	03-12-75	2400	44-15 N	17-36 W	244	29.3	120.0		53/55
2749	229	13	49	03-13-75	1200	38-53 N	32-04 W	246	29.4	120.5		55/61
2761	229	16	61	03-13-75	2400	38-53 N	32-04 W	273	16.8	69.1		55/58
2811	231	19	11	03-14-75	1200	39-16 N	44-00 W	273	16.8	69.1		58/61
2833	231	25	33	03-15-75	1200	39-29 N	52-40 W	273	17.4	71.7		58/54
2837	231	26	37	03-15-75	1600	39-29 N	52-40 W	273	17.5	72.3		58/63
2841	231	27	41	03-15-75	2000	39-29 N	52-40 W	273	17.0	70.0		58/60
2846	231	28	46	03-15-75	2400	39-29 N	52-40 W	273	16.6	68.0		63/62
2849	231	29	49	03-16-75	0400	39-29 N	52-40 W	273	16.3	67.0		65/52
2853	231	30	53	03-16-75	0800	39-29 N	52-40 W	270	17.1	70.5		61/55
2905	233	32	5	03-16-75	1400	39-54 N	60-37 W	270	17.1	70.4		60/53
2906	233	32	6	03-16-75	1400	39-54 N	60-37 W	270	17.1	70.4		60/53
2911	233	33	11	03-16-75	1600	39-54 N	60-37 W	270	17.1	70.8		64/52
2914	233	34	14	03-16-75	1800	39-54 N	60-37 W	270	17.1	70.6		64/52
2918	233	35	18	03-16-75	2000	39-54 N	60-37 W	270	17.6	72.5		66/45
2921	233	36	21	03-16-75	2400	39-54 N	60-37 W	270	18.0	74.1		48/49
2925	233	37	25	03-17-75	2400	39-54 N	60-37 W	270	17.2	71.0		60/53

TABLE 11b

SUMMARY OF TMR LOG-BOOK DATA CORRESPONDING TO
INTERVALS SELECTED FOR WAVE METER DATA REDUCTION (PAGE 2 OF 2)

SEA LAND MC LEAN : 1974-1975 WINTER SEASON : VOYAGE 61 WEST

D.L. RUN NO.	SEA STATE	<REL WIND> DIR/SPEED /(KT)	REL WAVE DIR	WAVE HT. FT.	REL SWELL DIR	<-SWELL-> HT FT.	LENGTH FT.	VISUAL WEATHER /TMR LOG-BOOK COMMENTS
2713	3	177P/10	177P	2	116S	2	500	PT CLDY /
2725	4	71S/15	71S	1	116S	2	600	CLEAR /
2737	4	3S/15	3S	1	19P	2	600	OCAST /
2749	3	55P/10	55P	1	21P	2	400	PT CLDY /
2761	2	87S/ 5	87S	1	87S	2	400	PT CLDY /
2811	1	42S/ 2	42S	1	87S	2	600	CLEAR /
2833	5	138P/20	138P	2	48P	2	400	OCAST /
2837	6	117P/25	117P	4	48P	4	400	OCAST /
2841	7	48P/30	48P	6	48P	6	400	OCAST /
2846	7	48P/30	48P	10	48P	10	600	OCAST /
2849	7	3P/35	3P	20	3P	20	600	OCAST /
2853	9	22S/45	22S	20	0	20	600	OCAST /
2905	7	67S/35	67S	15	67S	15	600	OCAST /
2906	7	67S/35	67S	15	67S	15	600	OCAST /
2911	6	67S/25	67S	10	67S	10	600	PT CLDY /
2914	6	67S/25	67S	10	67S	10	600	PT CLDY /
2918	5	67S/20	67S	10	67S	10	600	PT CLDY / END MANUAL RECORD
2921	4	67S/15	67S	6	67S	6	600	PT CLDY /
2925	3	67S/10	67S	2	67S	2	800	PT CLDY /

TABLE IIc

COMPARISON OF TMR RESULTS FOR MIDSHIP VERTICAL BENDING STRESS
WITH CORRESPONDING RAW DIGITIZATION RESULTS AT DAVIDSON LABORATORY

SEA LAND MC LEAN : 1974-1975 WINTER SEASON : VOYAGE 61 WEST

	TMR RESULTS					D.L. DIGITIZATION			COLUMN RATIOS		
D.L. RUN NO.	NO. WAVE INDUCED CYCLES (1)	NO. 1ST MODE BURSTS (2)	MAX P-TO-T STRESS KPSI (3)	RMS P-TO-T STRESS KPSI (4)	MAX 1ST MODE STRESS KPSI (5)	RANGE OF RECORDED EXTREMES KPSI (6)	2.83X (SAMPLE RMS) KPSI (7)	REL MEAN STRESS KPSI (8)	(7) / (4)	(6) / (3+5)	(6) / (3)
2713	95	0	3.91	1.70	0.00	4.56	1.98	0.08	1.16	1.17	1.17
2725	81	0	4.01	1.70	0.00	4.24	1.91	1.46	1.13	1.06	1.06
2737	153	2	3.84	1.69	0.71	4.56	1.79	-0.47	1.06	1.00	1.19
2749	161	0	2.53	1.39	0.00	3.54	1.53	0.22	1.10	1.40	1.40
2761	129	0	5.75	2.44	0.00	4.44	2.04	1.90	0.84	0.77	0.77
2811	149	0	2.72	1.22	0.00	3.01	1.30	0.65	1.06	1.11	1.11
2833	179	0	2.59	1.06	0.00	2.62	1.11	0.27	1.05	1.01	1.01
2837	165	0	2.05	0.99	0.00	2.46	1.04	0.06	1.05	1.20	1.20
2841	180	14	6.38	2.43	1.20	6.36	2.49	0.18	1.02	0.84	1.00
2846	166	37	9.41	4.10	2.18	10.01	3.94	0.35	0.96	0.86	1.06
2849	164	43	11.64	4.92	3.34	12.93	4.51	0.65	0.92	0.86	1.11
2853	144	69	15.33	5.94	2.78	14.20	5.25	0.71	0.88	0.78	0.93
2905	148	72	17.38	7.58	4.74	17.56	7.39	0.22	0.98	0.79	1.01
2906	152	92	13.96	6.40	3.85	17.03	5.93	2.22	0.93	0.96	1.22
2911	150	37	10.19	4.42	2.72	10.93	4.16	0.10	0.94	0.85	1.07
2914	156	22	8.71	3.59	1.56	9.52	3.45	-0.03	0.96	0.93	1.09
2918	157	17	6.46	3.16	1.43	6.77	2.99	0.13	0.95	0.86	1.05
2921	149	3	4.04	1.86	0.67	4.65	1.95	0.19	1.05	0.99	1.15
2925	123	0	2.93	1.11	0.00	3.03	1.20	0.13	1.08	1.04	1.04

TABLE IId

SUMMARY OF RAW DIGITIZATION RESULTS FOR RADAR RANGE
ROLL, PITCH, DECK HOUSE ACCELERATIONS, AND TUCKER METER

SEA LAND MC LEAN : 1974-1975 WINTER SEASON : VOYAGE 61 WEST

	<--- RADAR	--->		<--- ROLL	---->		<--- PITCH	--->		<--VERT ACCEL	->		<--LAT ACCEL	-->		<-- TUCKER	-->	
D.L. RUN NO.	4.0 (RMS) FT	RECORDED EXTREMES FT	FT	4.0 (RMS) DEG	RECORDED EXTREMES DEG	DEG	4.0 (RMS) DEG	RECORDED EXTREMES DEG	DEG	4.0 (RMS) (G)	RECORDED EXTREMES (G)	(G)	4.0 (RMS) (G)	RECORDED EXTREMES (G)	(G)	4.0 (RMS) FT	RECORDED EXTREMES FT	FT
2713	19.	16.	-16.	7.6	5.	-8.	0.8	2.2	-1.3	0.24	0.2	-0.2	0.16	0.1	-0.1	3.	3.	-3.
2725	17.	14.	-13.	8.8	5.	-8.	0.7	2.2	-0.9	0.15	0.1	-0.1	0.18	0.1	-0.1	2.	2.	-2.
2737	16.	17.	-13.	4.4	3.	-4.	1.0	2.5	-1.3	0.24	0.2	-0.2	0.10	0.1	-0.1	2.	2.	-2.
2749	14.	12.	-13.	4.2	3.	-3.	0.9	2.3	-1.2	0.21	0.2	-0.2	0.11	0.1	-0.1	2.	2.	-2.
2761	19.	17.	-16.	3.2	2.	-5.	1.2	2.4	-1.4	0.24	0.2	-0.2	0.10	0.1	-0.1	3.	2.	-3.
2811	13.	12.	-10.	4.2	3.	-4.	0.7	2.2	-0.9	0.17	0.1	-0.1	0.10	0.1	-0.1	2.	2.	-2.
2833	10.	9.	-8.	2.9	1.	-4.	0.7	2.2	-0.9	0.16	0.1	-0.1	0.09	0.1	-0.1	2.	1.	-1.
2837	11.	10.	-11.	2.7	4.	-1.	0.7	2.1	-1.0	0.17	0.1	-0.1	0.09	0.1	-0.1	1.	1.	-1.
2841	23.	16.	-29.	3.9	5.	-2.	1.3	2.7	-1.6	0.39	0.3	-0.3	0.11	0.1	-0.1	3.	2.	-3.
2846	33.	28.	-37.	3.9	7.	-2.	1.6	1.3	-1.6	0.48	0.4	-0.4	0.12	0.1	-0.1	3.	3.	-3.
2849	36.	27.	-39.	3.7	3.	-3.	1.6	1.0	-1.7	0.43	0.4	-0.4	0.11	0.1	-0.1	4.	3.	-4.
2853	42.	33.	-50.	3.7	2.	-4.	1.9	1.4	-1.8	0.50	0.4	-0.4	0.10	0.1	-0.1	5.	3.	-4.
2905	62.	41.	-61.	5.4	1.	-7.	2.4	1.8	-2.0	0.62	0.5	-0.5	0.14	0.1	-0.1	5.	4.	-4.
2926	52.	40.	-54.	5.2	1.	-7.	2.1	1.3	-1.8	0.57	0.5	-0.5	0.13	0.1	-0.1	4.	4.	-4.
2911	44.	31.	-44.	4.8	2.	-7.	1.9	1.2	-1.8	0.50	0.4	-0.4	0.12	0.1	-0.1	5.	4.	-4.
2914	39.	30.	-41.	5.6	3.	-7.	1.6	0.9	-1.7	0.46	0.4	-0.4	0.14	0.1	-0.1	5.	4.	-4.
2918	31.	26.	-31.	6.7	3.	-9.	1.4	0.8	-1.6	0.40	0.3	-0.4	0.15	0.1	-0.1	5.	3.	-4.
2921	16.	14.	-23.	4.3	3.	-5.	1.0	0.5	-1.2	0.25	0.2	-0.2	0.12	0.1	-0.1	3.	3.	-3.
2925	9.	9.	-8.	2.6	1.	-3.	0.7	2.2	-1.2	0.15	0.1	-0.1	0.09	0.1	-0.1	2.	2.	-2.

LOG BOOK DATA

DATE AND TIME	03-11-75 2400
POSITION	50-02 N 00-47 W
COURSE AND SPEED	244 , 33.1 KNOTS
SEA STATE	3
WAVE HEIGHT	2 FEET
" REL DIR	177 PORT
SWELL HEIGHT	2 FEET
" REL DIR	116 STBD

---- VISUAL WEATHER / COMMENTS ----

PT CLDY /

MIDSHIP VERTICAL BENDING STRESS

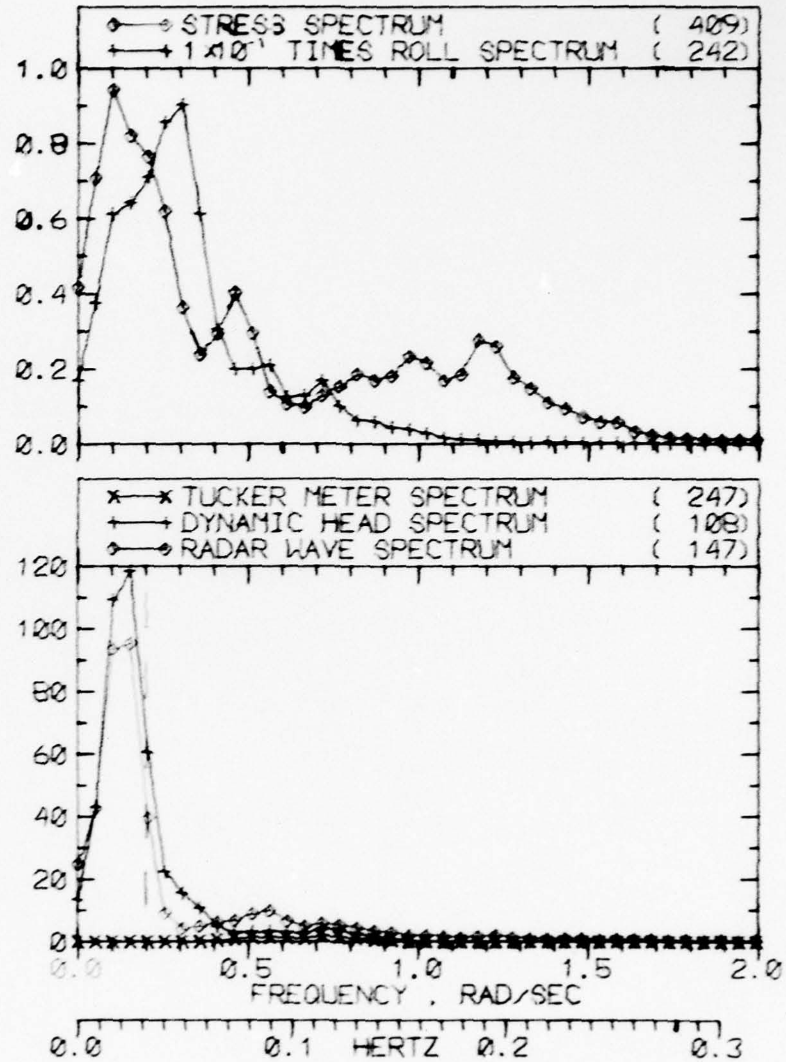
MAXIMUM PK-TR	3.9 KPSI
4.0 X RMS	2.8 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

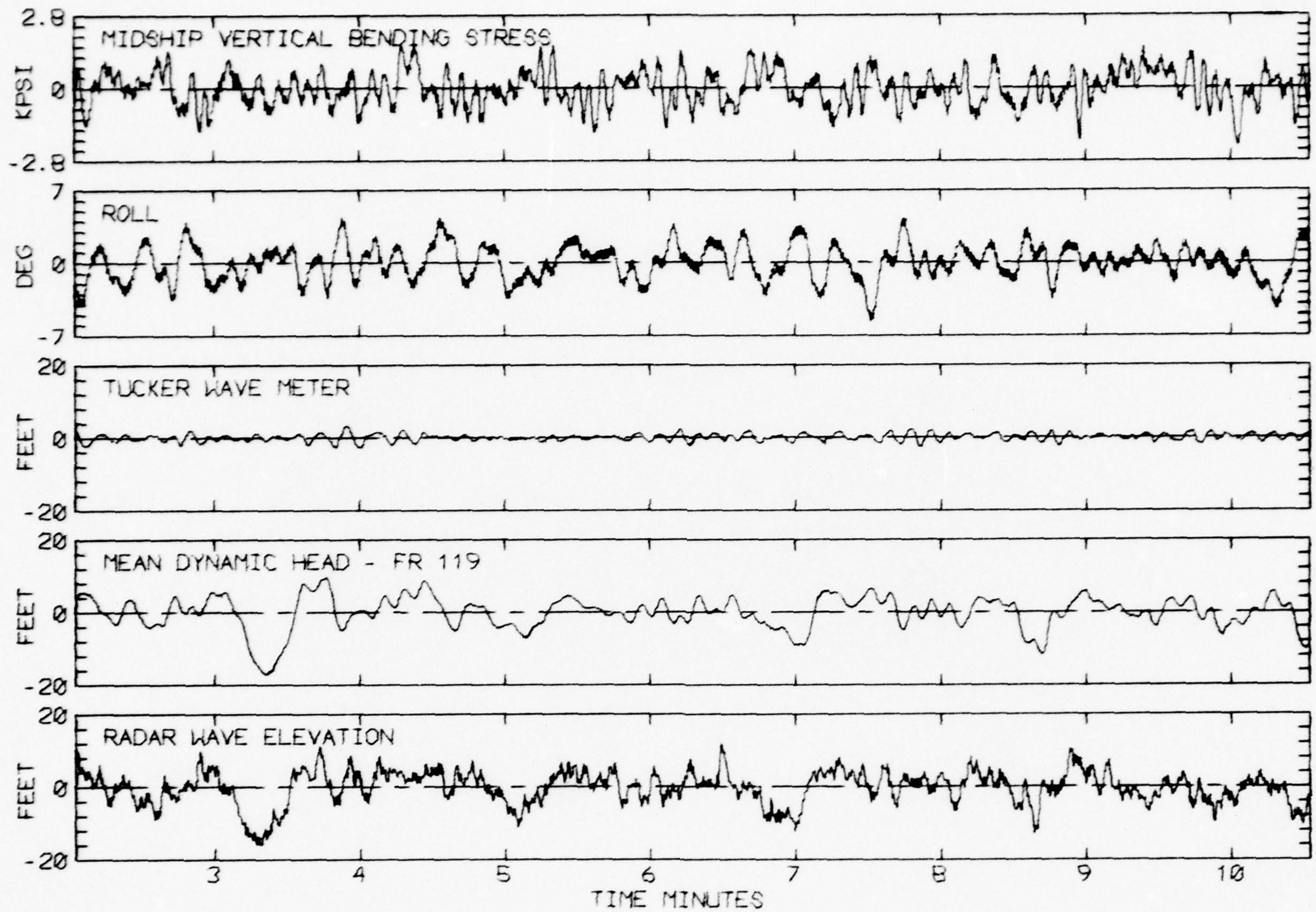
ROLL	7.4 DEG
PITCH	0.85 DEG
DK HSE VERT ACCEL	0.24 G
DK HSE LAT ACCEL	0.16 G
RADAR SLANT RANGE	18.9 FEET
VERTICAL RANGE	16.6 FEET
DISPL AT RADAR	20.8 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER	DYN. HEAD	RADAR
P-T SAMPLE SIZE	276	57	255
MAXIMUM HEIGHT	6.1	22.7	18.0
10TH HIGHEST HTS	3.8	18.2	12.6
3RD HIGHEST HTS	2.5	13.1	8.5
4.0 RMS(SPECTRA)	3.5	18.5	18.2



RUN 2713 -- VOYAGE 61W -- TAPE 229 -- INDEX 4 -- INTERVAL 13



RUN 2713 -- VOYAGE 61W -- TAPE 229 -- INDEX 4 -- INTERVAL 13

LOG BOOK DATA	
DATE AND TIME	03-12-75 1200
POSITION	44-15 N 17-36 W
COURSE AND SPEED	244 , 32.2 KNOTS
SEA STATE	4
WAVE HEIGHT	1 FEET
" REL DIR	71 STBD
SWELL HEIGHT	2 FEET
" REL DIR	116 STBD

---- VISUAL WEATHER / COMMENTS ----

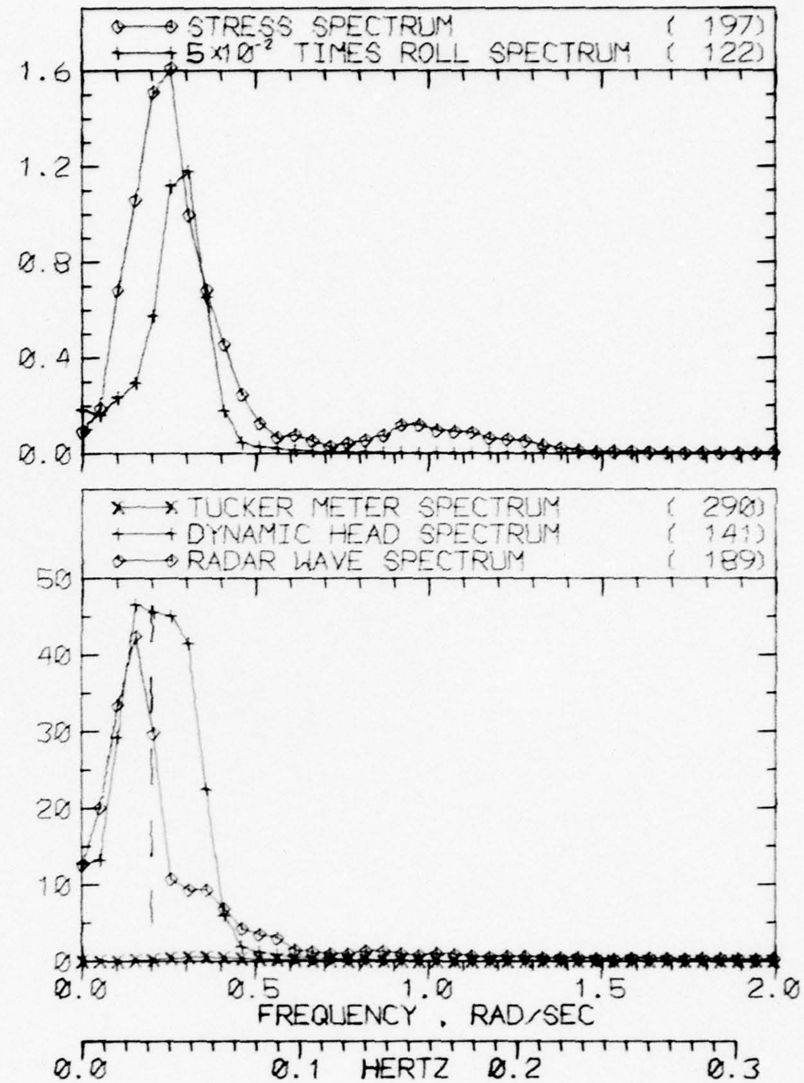
CLEAR /

MIDSHIP VERTICAL BENDING STRESS	
MAXIMUM PK-TR	4.0 KPSI
4.0 X RMS	2.7 KPSI

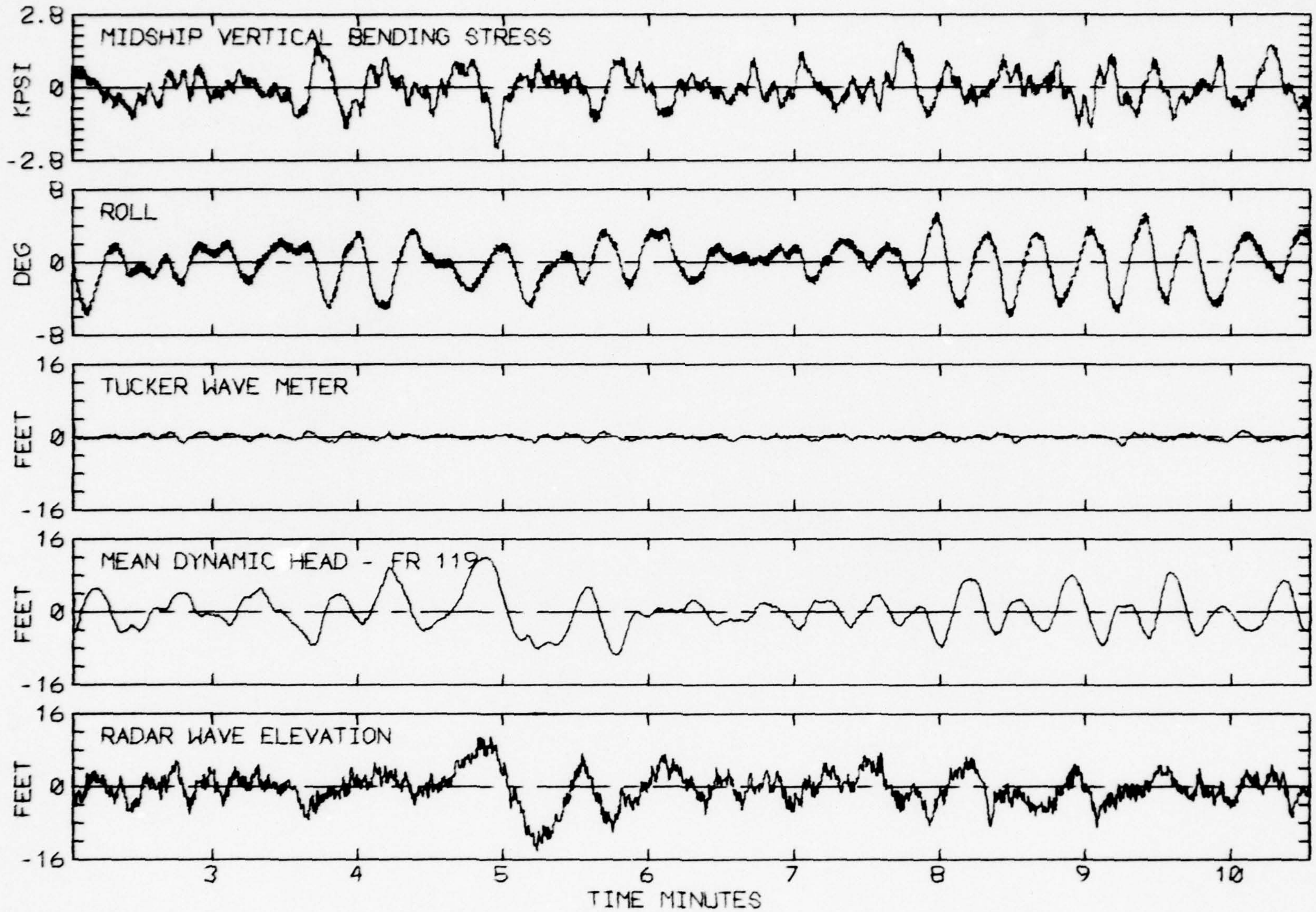
SUMMARY OF MOTIONS (4.0 X RMS)	
ROLL	8.8 DEG
PITCH	0.67 DEG
DK HSE VERT ACCEL	0.15 G
DK HSE LAT ACCEL	0.18 G
RADAR SLANT RANGE	17.0 FEET
VERTICAL RANGE	13.9 FEET
DISPL AT RADAR	16.3 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/	DYN. HEAD/	RADAR
P-T SAMPLE SIZE	579	56	362
MAXIMUM HEIGHT	2.0	20.1	17.5
10TH HIGHEST HTS	1.3	14.5	8.7
3RD HIGHEST HTS	0.9	10.6	5.8
4.0 RMS(SPECTRA)	2.0	14.6	13.1



RUN 2725 -- VOYAGE 61W -- TAPE 229 -- INDEX 7 -- INTERVAL 25



RUN 2725 -- VOYAGE 61W -- TAPE 229 -- INDEX 7 -- INTERVAL 25

LOG BOOK DATA

DATE AND TIME	03-12-75 2400
POSITION	44-15 N 17-36 W
COURSE AND SPEED	244 . 29.3 KNOTS
SEA STATE	4
WAVE HEIGHT	1 FEET
" REL DIR	3 STBD
SWELL HEIGHT	2 FEET
" REL DIR	19 PORT

---- VISUAL WEATHER / COMMENTS ----

OCAST /

MIDSHIP VERTICAL BENDING STRESS

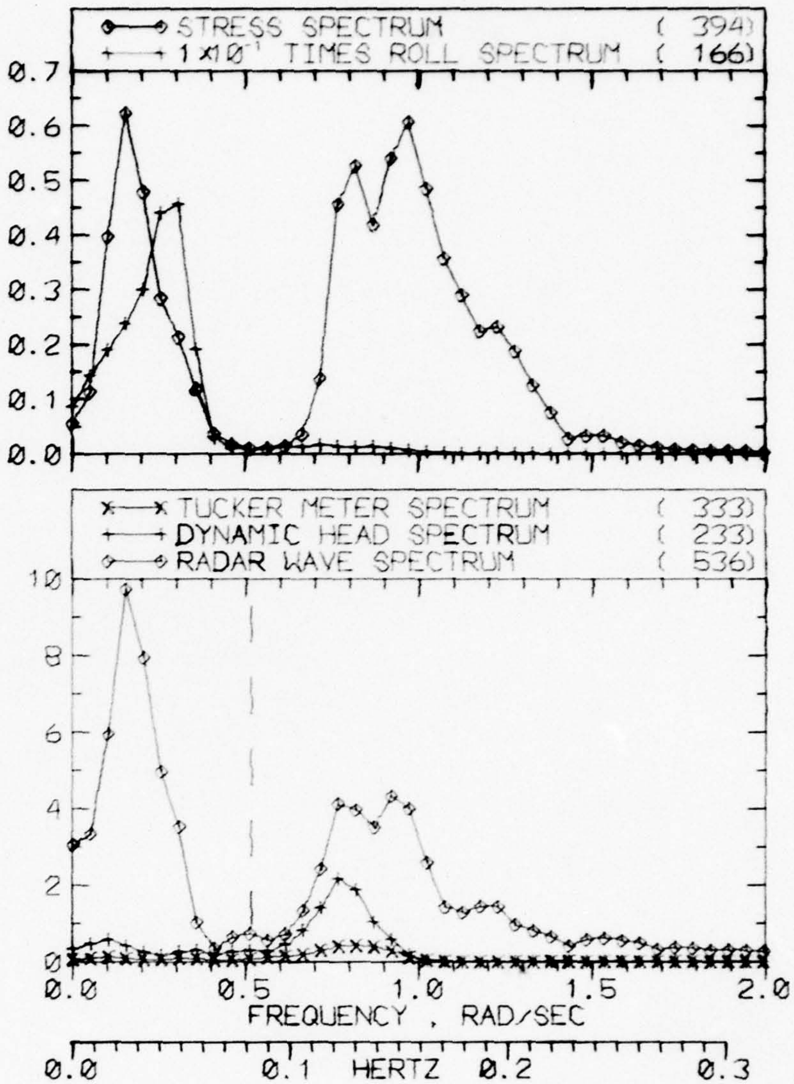
MAXIMUM PK-TR	3.8 KPSI
4.0 X RMS	2.5 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

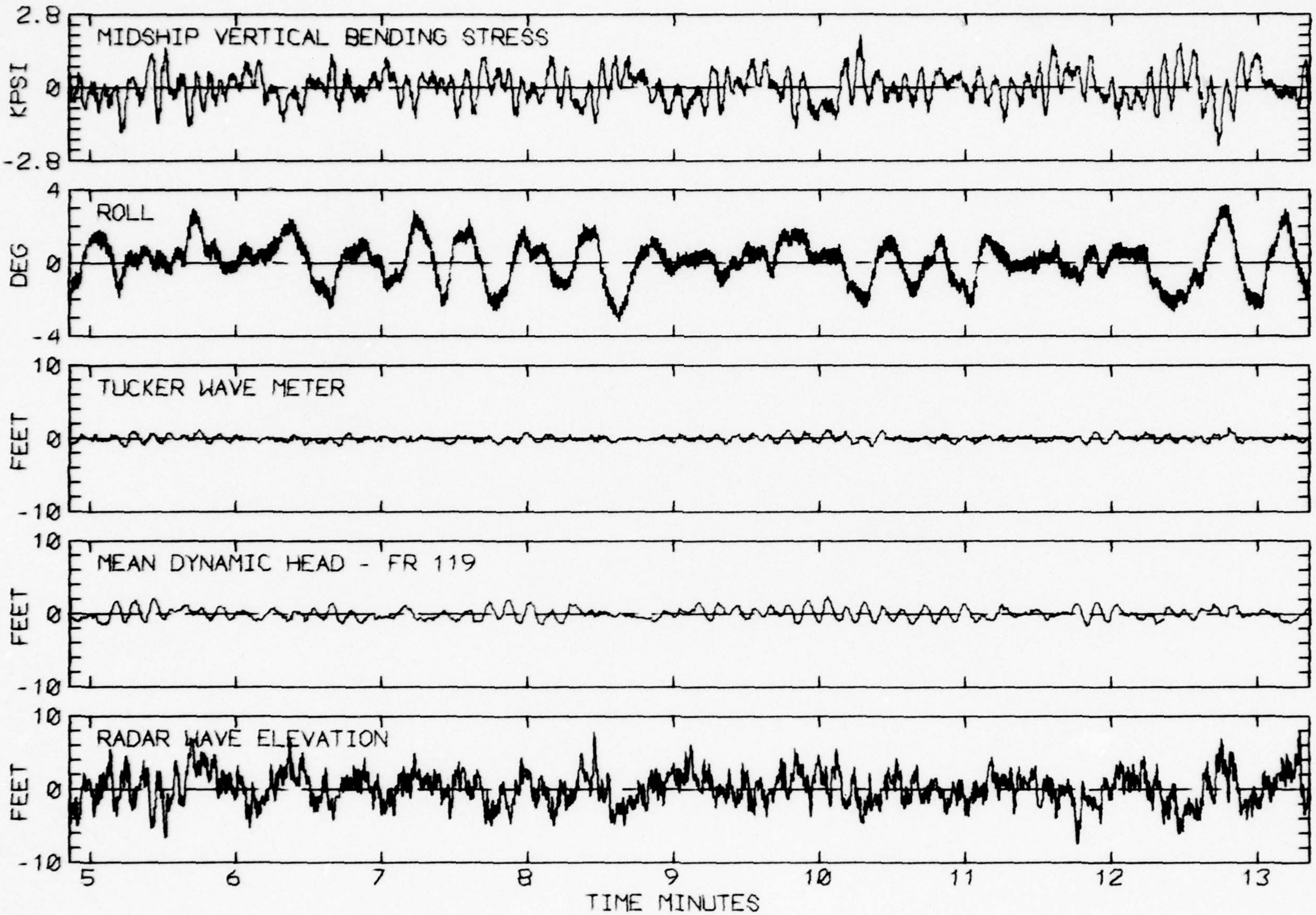
ROLL	4.4 DEG
PITCH	0.96 DEG
DK HSE VERT ACCEL	0.24 G
DK HSE LAT ACCEL	0.10 G
RADAR SLANT RANGE	16.3 FEET
VERTICAL RANGE	15.2 FEET
DISPL AT RADAR	10.0 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	629	238	497
MAXIMUM HEIGHT	2.4	4.6	9.8
10TH HIGHEST HTS	1.3	3.3	7.9
3RD HIGHEST HTS	0.9	2.3	5.7
4.0 RMS(SPECTRA)	1.8	3.2	9.0



RUN 2737 -- VOYAGE 61W -- TAPE 229 -- INDEX 10 -- INTERVAL 37



RUN 2737 -- VOYAGE 61W -- TAPE 229 -- INDEX 10 -- INTERVAL 37

LOG BOOK DATA

DATE AND TIME	03-13-75 1200
POSITION	38-53 N 32-04 W
COURSE AND SPEED	246 , 29.4 KNOTS
SEA STATE	3
WAVE HEIGHT	1 FEET
" REL DIR	55 PORT
SWELL HEIGHT	2 FEET
" REL DIR	21 PORT

---- VISUAL WEATHER / COMMENTS ----

PT CLDY /

MIDSHIP VERTICAL BENDING STRESS

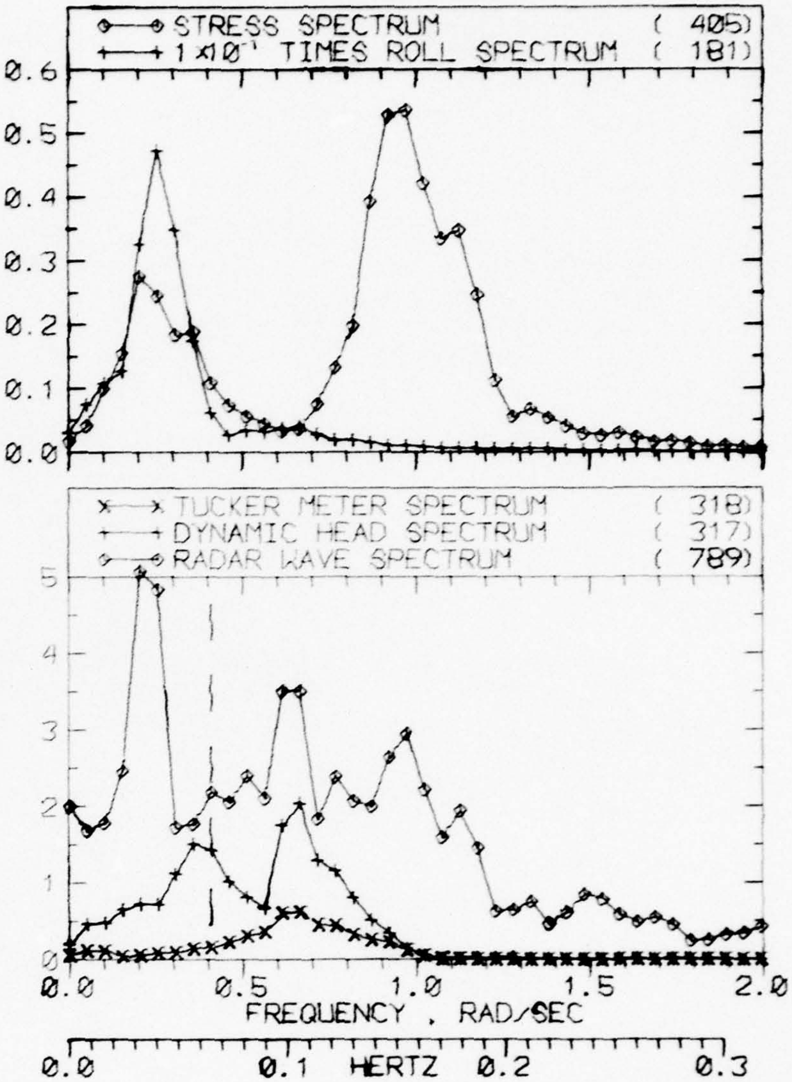
MAXIMUM PK-TR	2.5 KPSI
4.0 X RMS	2.1 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

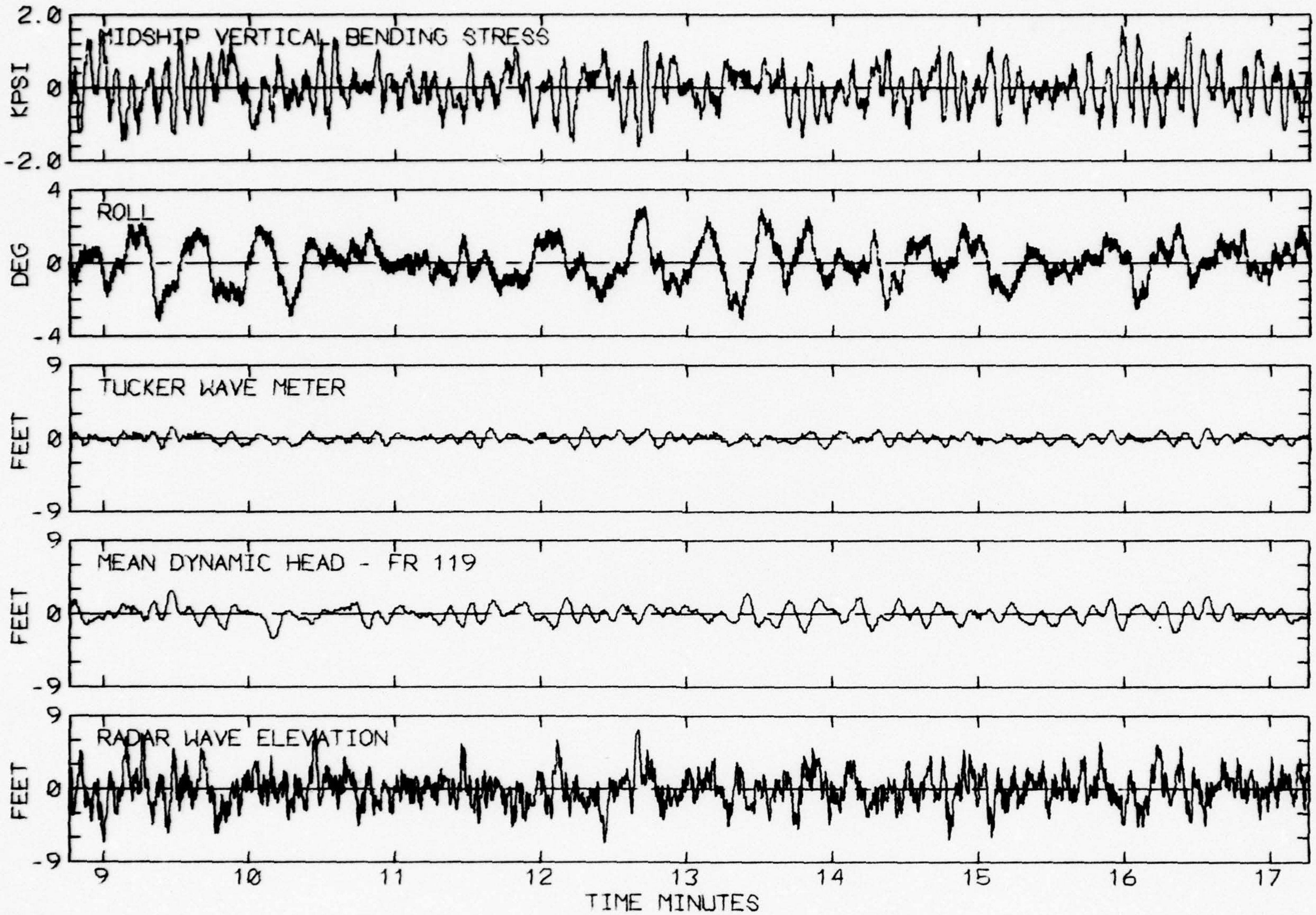
ROLL	4.2 DEG
PITCH	0.88 DEG
DK HSE VERT ACCEL	0.21 G
DK HSE LAT ACCEL	0.11 G
RADAR SLANT RANGE	13.5 FEET
VERTICAL RANGE	12.4 FEET
DISPL AT RADAR	9.0 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	466	217	556
MAXIMUM HEIGHT	3.1	5.3	13.1
10TH HIGHEST HTS	1.7	3.9	7.5
3RD HIGHEST HTS	1.1	2.6	5.4
4.0 RMS(SPECTRA)	2.1	3.9	8.2



RUN 2749 -- VOYAGE 61W -- TAPE 229 -- INDEX 13 -- INTERVAL 49



RUN 2749 -- VOYAGE 61W -- TAPE 229 -- INDEX 13 -- INTERVAL 49

LOG BOOK DATA

DATE AND TIME	03-13-75 2400
POSITION	38-53 N 32-04 W
COURSE AND SPEED	273 . 16.8 KNOTS
SEA STATE	2
WAVE HEIGHT	1 FEET
" REL DIR	87 STBD
SWELL HEIGHT	2 FEET
" REL DIR	87 STBD

---- VISUAL WEATHER / COMMENTS ----

PT CLDY /

MIDSHIP VERTICAL BENDING STRESS

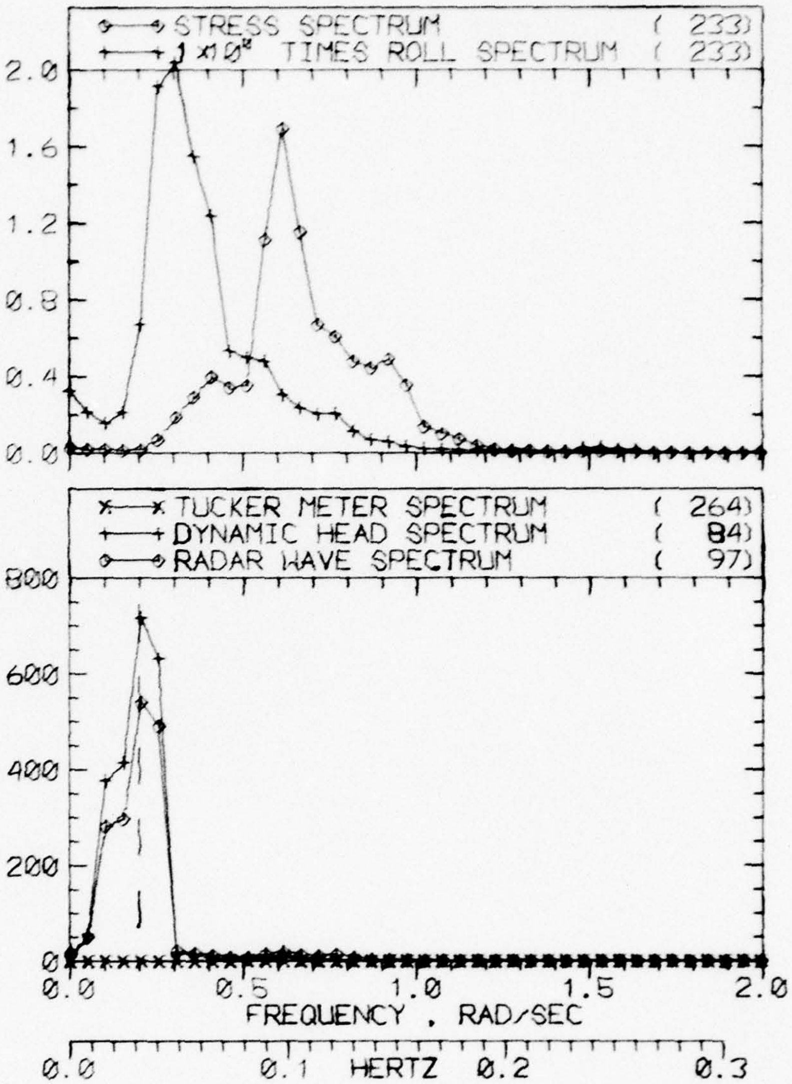
MAXIMUM PK-TR	5.8 KPSI
4.0 X RMS	2.8 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

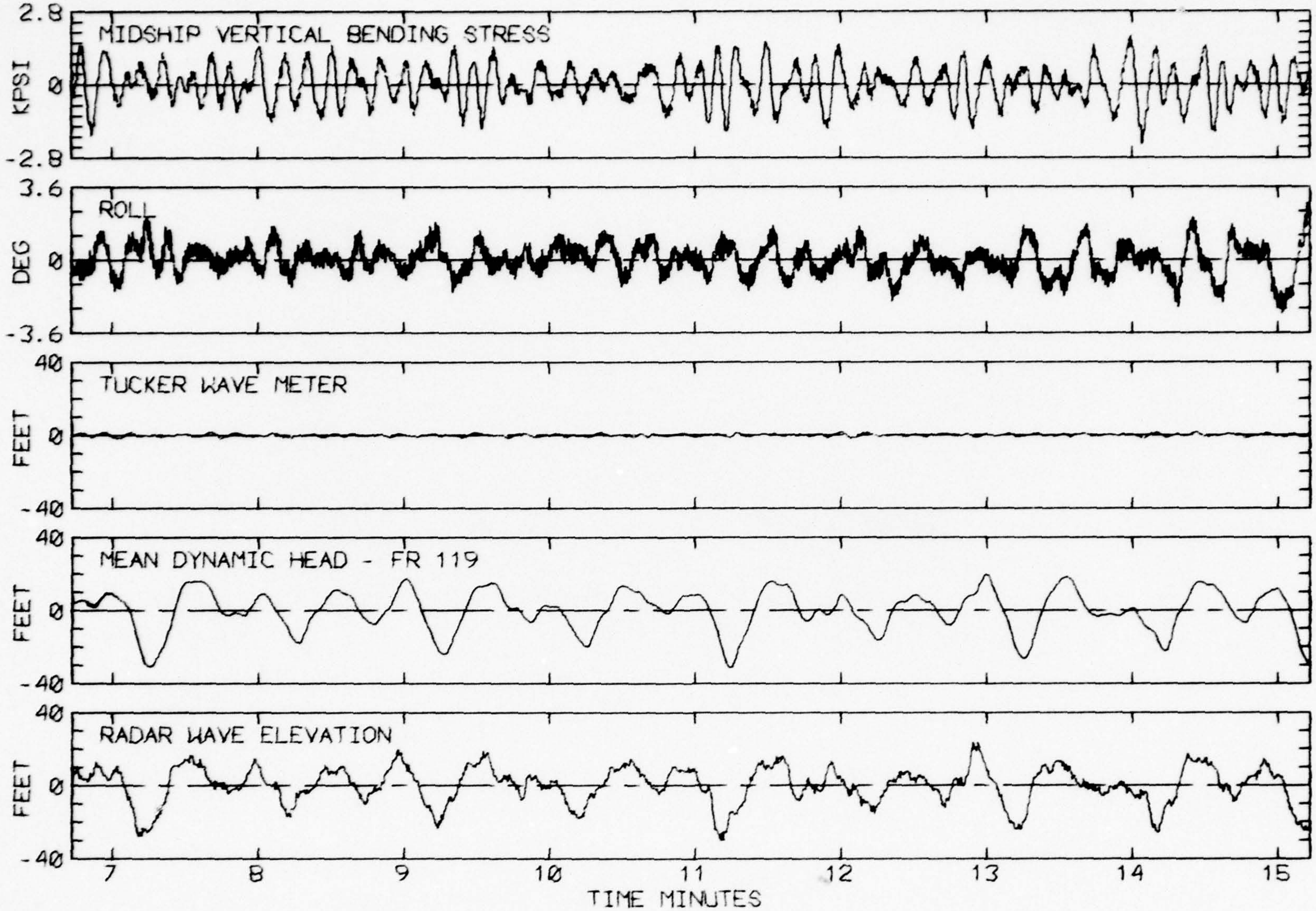
ROLL	3.3 DEG
PITCH	0.97 DEG
DK HSE VERT ACCEL	0.24 G
DK HSE LAT ACCEL	0.10 G
RADAR SLANT RANGE	19.1 FEET
VERTICAL RANGE	17.5 FEET
DISPL AT RADAR	41.0 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	405	35	110
MAXIMUM HEIGHT	4.0	46.1	43.0
10TH HIGHEST HTS	2.2	42.7	34.1
3RD HIGHEST HTS	1.4	34.4	22.8
4.0 RMS(SPECTRA)	2.6	43.1	38.9



RUN 2761 -- VOYAGE 61W -- TAPE 229 -- INDEX 16 -- INTERVAL 61



RUN 2761 -- VOYAGE 61W -- TAPE 229 -- INDEX 16 -- INTERVAL 61

LOG BOOK DATA	
DATE AND TIME	03-14-75 1200
POSITION	39-16 N 44-00 W
COURSE AND SPEED	273 . 16.8 KNOTS
SEA STATE	1
WAVE HEIGHT	1 FEET
" REL DIR	42 STBD
SWELL HEIGHT	2 FEET
" REL DIR	87 STBD

---- VISUAL WEATHER / COMMENTS ----

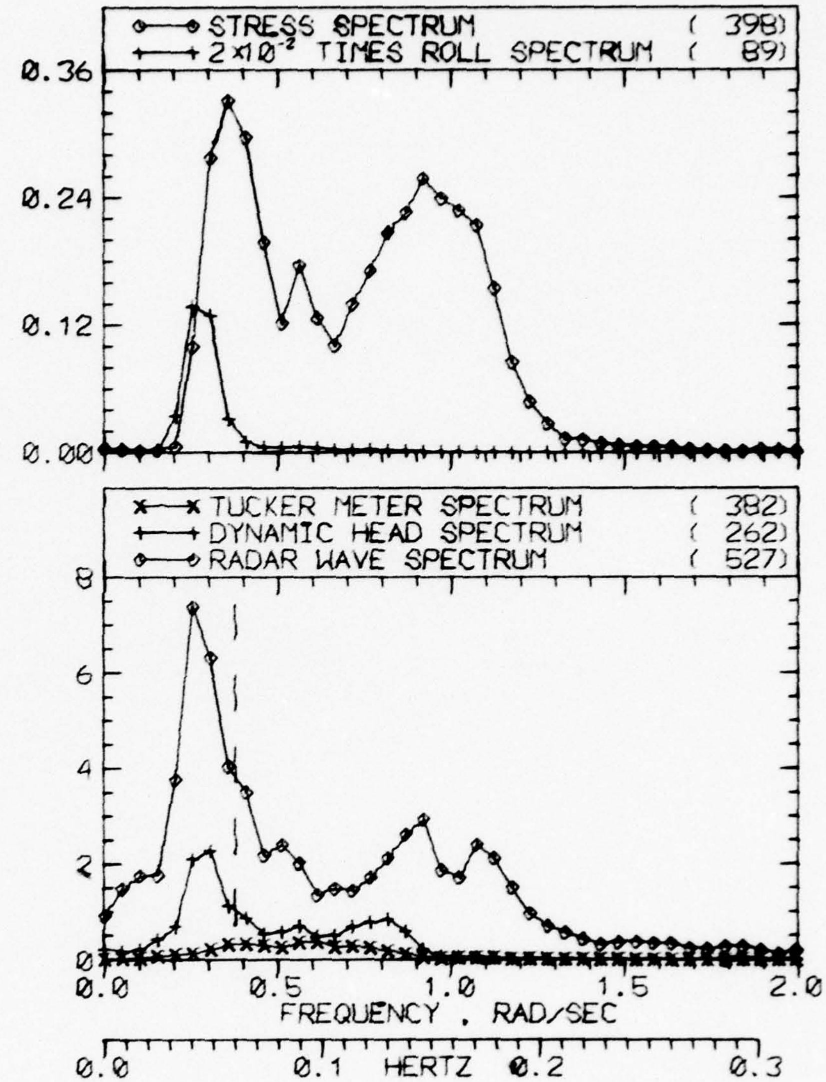
CLEAR /

MIDSHIP VERTICAL BENDING STRESS	
MAXIMUM PK-TR	2.7 KPSI
4.0 X RMS	1.8 KPSI

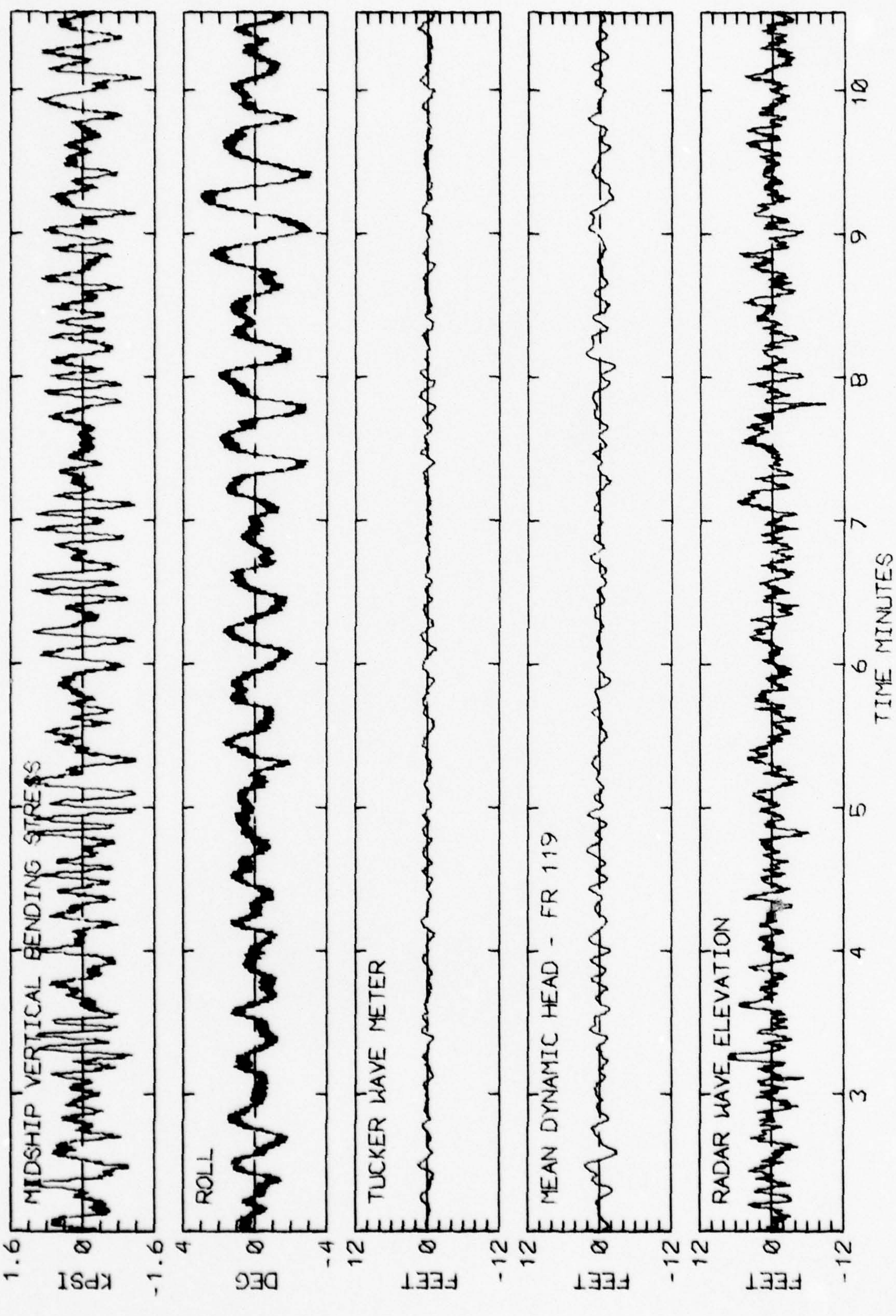
SUMMARY OF MOTIONS (4.0 X RMS)	
ROLL	4.1 DEG
PITCH	0.74 DEG
DK HSE VERT ACCEL	0.17 G
DK HSE LAT ACCEL	0.10 G
RADAR SLANT RANGE	12.5 FEET
VERTICAL RANGE	11.4 FEET
DISPL AT RADAR	7.6 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	534	197	540
MAXIMUM HEIGHT	2.7	5.4	13.7
10TH HIGHEST HTS	1.6	3.2	7.1
3RD HIGHEST HTS	1.1	2.3	4.7
4.0 RMS(SPECTRA)	1.9	3.5	7.9



RUN 2811 -- VOYAGE 61W -- TAPE 231 -- INDEX 19 -- INTERVAL 11



RUN 2811 -- VOYAGE 61W -- TAPE 231 -- INDEX 19 -- INTERVAL 11

LOG BOOK DATA	
DATE AND TIME	03-15-75 1200
POSITION	39-29 N 52-40 W
COURSE AND SPEED	273 . 17.4 KNOTS
SEA STATE	5
WAVE HEIGHT	2 FEET
" REL DIR	138 PORT
SWELL HEIGHT	2 FEET
" REL DIR	48 PORT

---- VISUAL WEATHER / COMMENTS ----

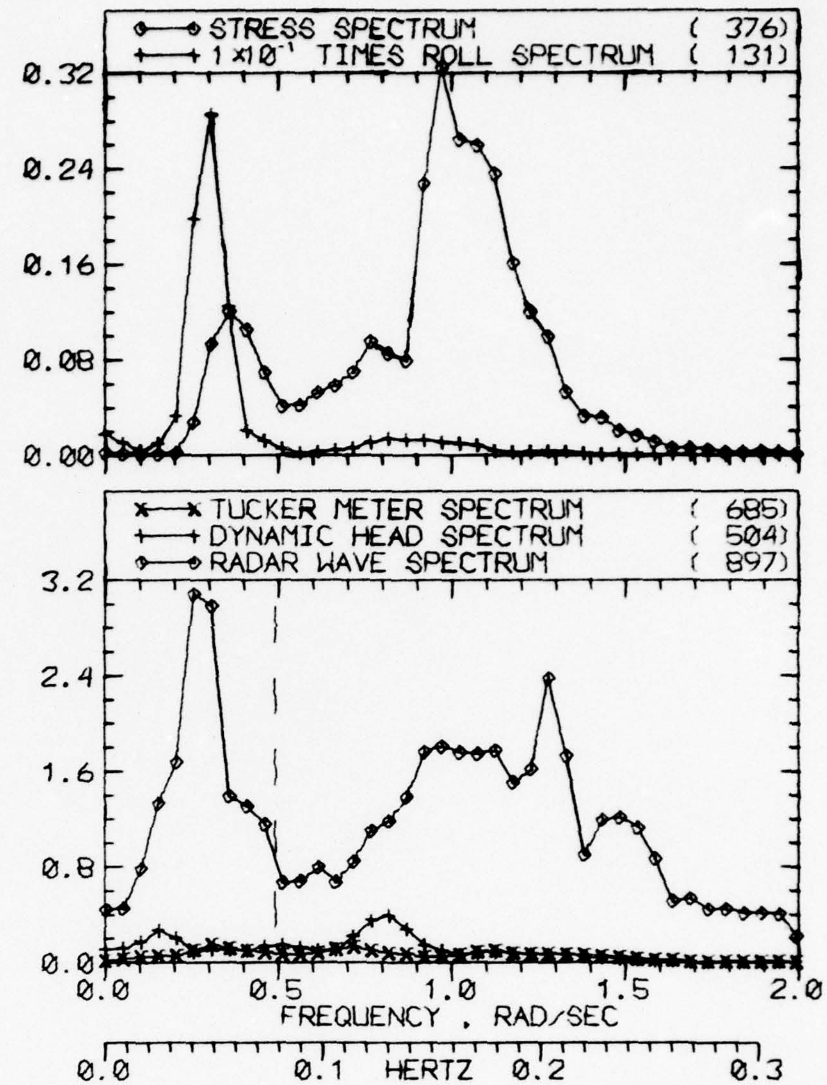
OCAST /

MIDSHIP VERTICAL BENDING STRESS	
MAXIMUM PK-TR	2.6 KPSI
4.0 X RMS	1.6 KPSI

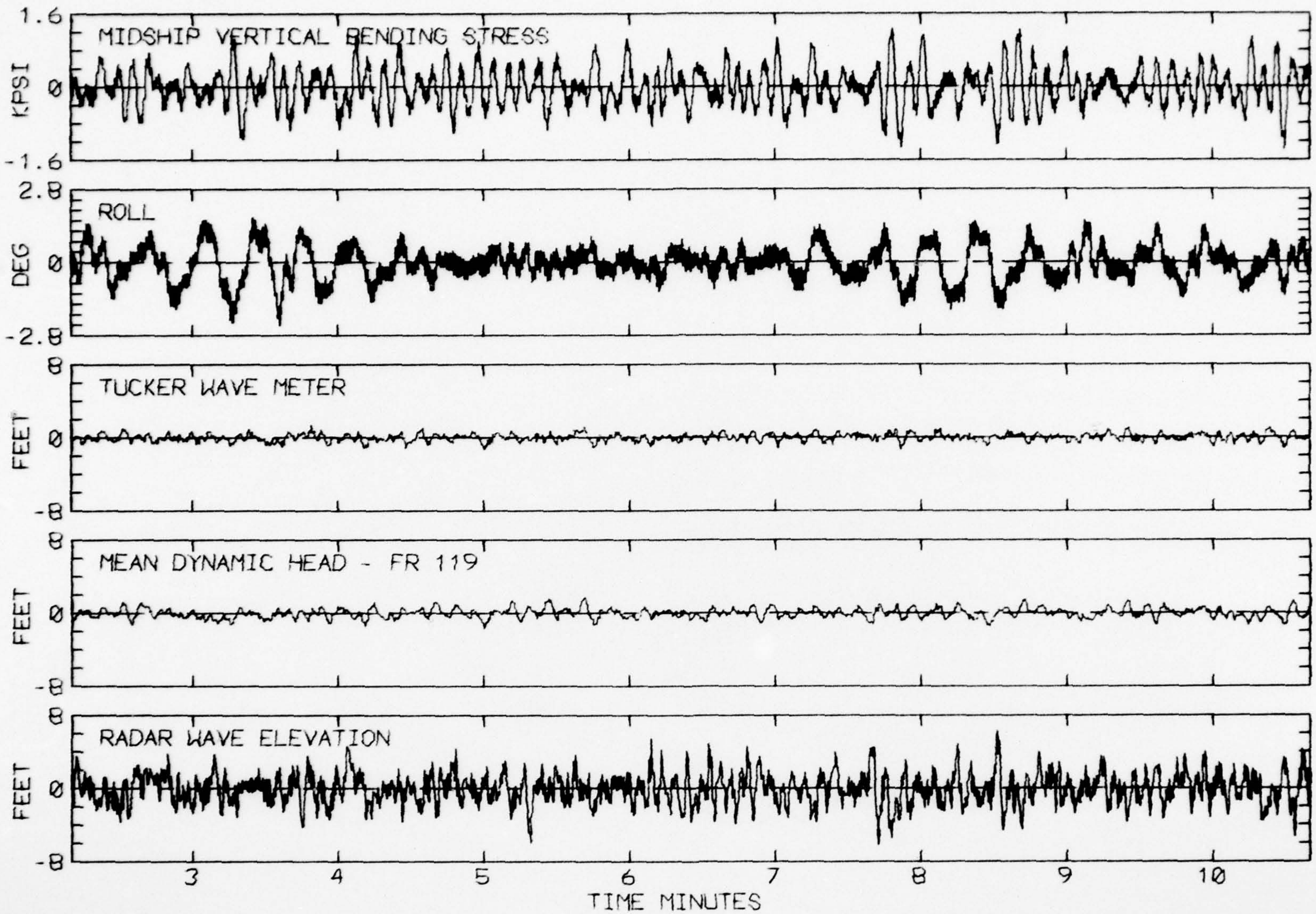
SUMMARY OF MOTIONS (4.0 X RMS)	
ROLL	2.8 DEG
PITCH	0.70 DEG
DK HSE VERT ACCEL	0.16 G
DK HSE LAT ACCEL	0.09 G
RADAR SLANT RANGE	9.7 FEET
VERTICAL RANGE	9.1 FEET
DISPL AT RADAR	5.1 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	685	416	646
MAXIMUM HEIGHT	2.2	2.5	11.3
10TH HIGHEST HTS	1.3	1.8	6.0
3RD HIGHEST HTS	0.9	1.3	4.3
4.0 RMS(SPECTRA)	1.6	1.9	7.0



RUN 2833 -- VOYAGE 61W -- TAPE 231 -- INDEX 25 -- INTERVAL 33



RUN 2833 -- VOYAGE 61W -- TAPE 231 -- INDEX 25 -- INTERVAL 33

LOG BOOK DATA	
DATE AND TIME	03-15-75 1600
POSITION	39-29 N 52-40 W
COURSE AND SPEED	273 . 17.5 KNOTS
SEA STATE	6
WAVE HEIGHT	4 FEET
" REL DIR	117 PORT
SWELL HEIGHT	4 FEET
" REL DIR	48 PORT

---- VISUAL WEATHER / COMMENTS ----

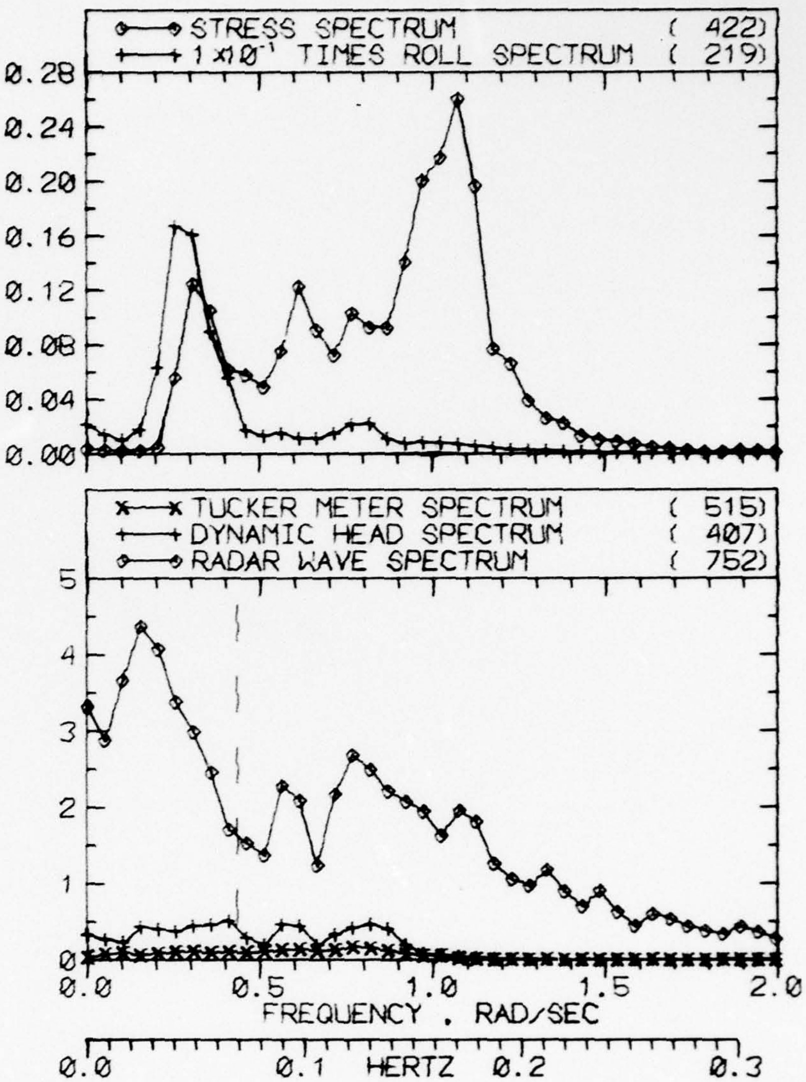
OCAST /

MIDSHIP VERTICAL BENDING STRESS	
MAXIMUM PK-TR	2.1 KPSI
4.0 X RMS	1.5 KPSI

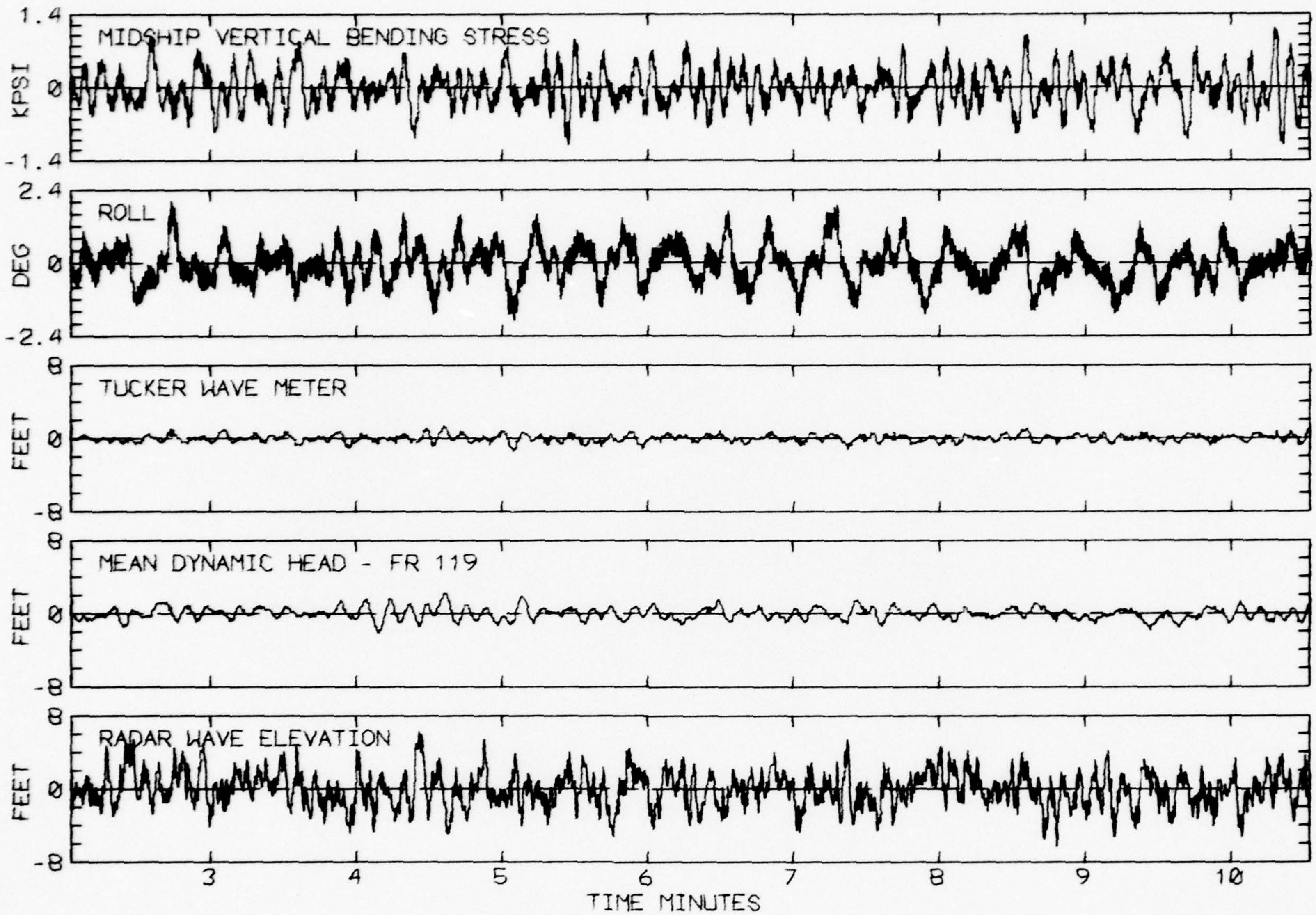
SUMMARY OF MOTIONS (4.0 X RMS)	
ROLL	2.8 DEG
PITCH	0.73 DEG
DK HSE VERT ACCEL	0.17 G
DK HSE LAT ACCEL	0.09 G
RADAR SLANT RANGE	10.8 FEET
VERTICAL RANGE	10.1 FEET
DISPL AT RADAR	6.1 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	733	271	522
MAXIMUM HEIGHT	2.0	3.8	10.1
10TH HIGHEST HTS	1.1	2.3	7.0
3RD HIGHEST HTS	0.8	1.5	5.0
4.0 RMS(SPECTRA)	1.5	2.5	8.0



RUN 2837 -- VOYAGE 61W -- TAPE 231 -- INDEX 26 -- INTERVAL 37



RUN 2837 -- VOYAGE 61W -- TAPE 231 -- INDEX 26 -- INTERVAL 37

LOG BOOK DATA	
DATE AND TIME	03-15-75 2000
POSITION	39-29 N 52-40 W
COURSE AND SPEED	273 . 17.0 KNOTS
SEA STATE	7
WAVE HEIGHT	6 FEET
" REL DIR	48 PORT
SWELL HEIGHT	6 FEET
" REL DIR	48 PORT

---- VISUAL WEATHER / COMMENTS ----

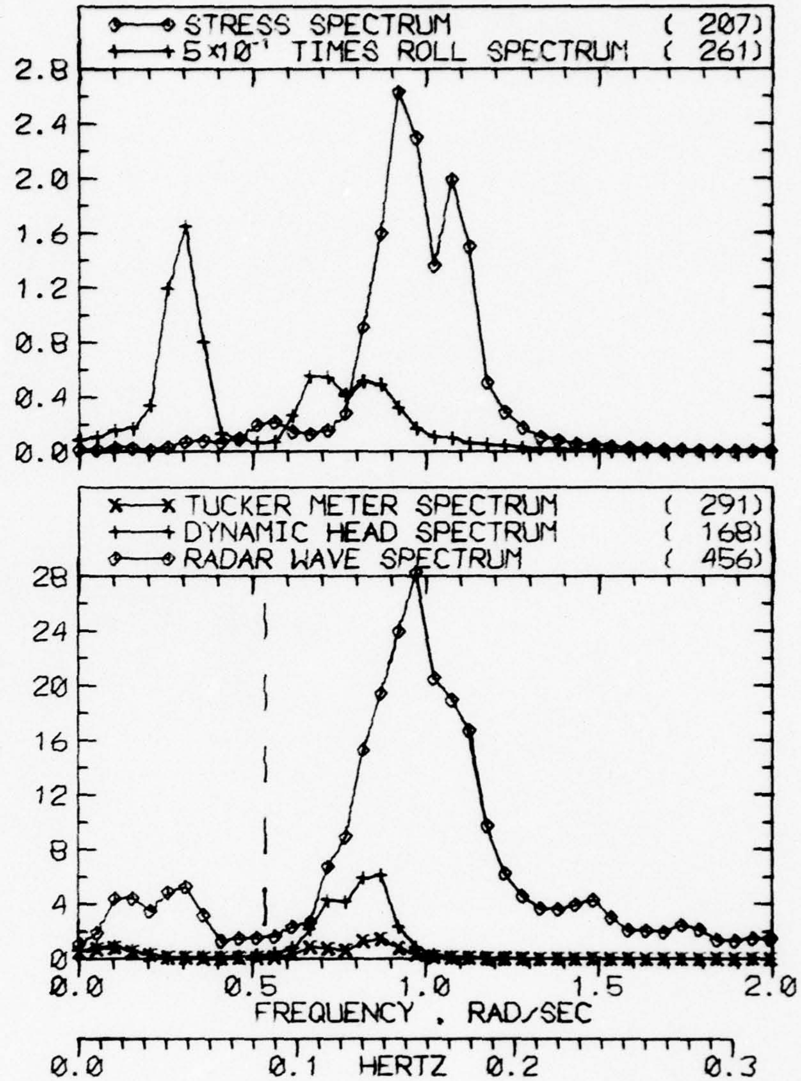
OCAST /

MIDSHIP VERTICAL BENDING STRESS	
MAXIMUM PK-TR	6.4 KPSI
4.0 X RMS	3.6 KPSI

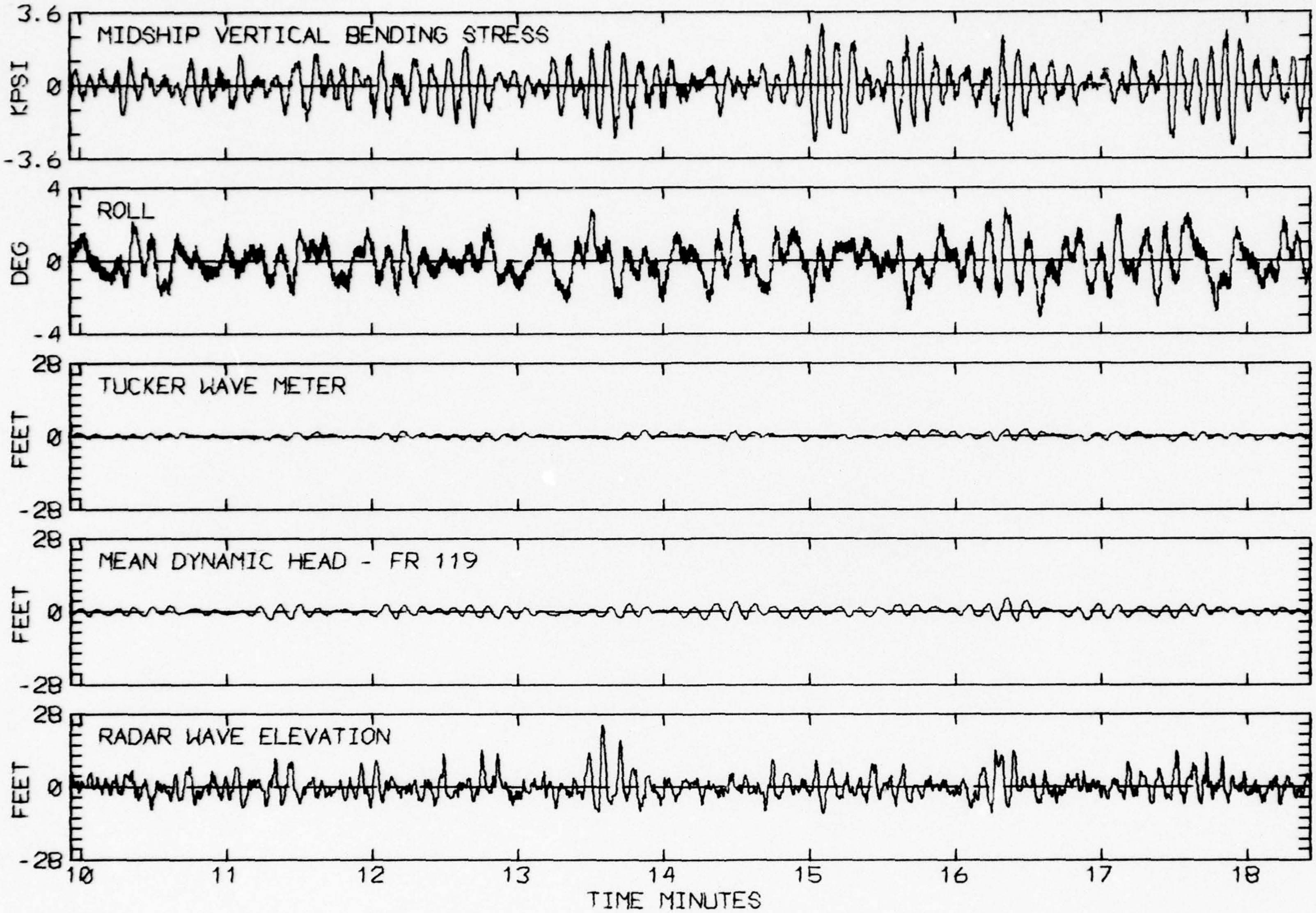
SUMMARY OF MOTIONS (4.0 X RMS)	
ROLL	3.9 DEG
PITCH	1.30 DEG
DK HSE VERT ACCEL	0.39 G
DK HSE LAT ACCEL	0.11 G
RADAR SLANT RANGE	22.9 FEET
VERTICAL RANGE	22.6 FEET
DISPL AT RADAR	16.7 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/	DYN. HEAD/	RADAR
P-T SAMPLE SIZE	378	179	357
MAXIMUM HEIGHT	4.0	8.9	31.4
10TH HIGHEST HTS	2.6	6.0	17.5
3RD HIGHEST HTS	1.7	4.6	12.0
4.0 RMS(SPECTRA)	3.0	5.1	15.3



RUN 2841 -- VOYAGE 61W -- TAPE 231 -- INDEX 27 -- INTERVAL 41



RUN 2841 -- VOYAGE 61W -- TAPE 231 -- INDEX 27 -- INTERVAL 41

LOG BOOK DATA

DATE AND TIME	03-15-75 2400
POSITION	39-29 N 52-40 W
COURSE AND SPEED	273 . 16.6 KNOTS
SEA STATE	7
WAVE HEIGHT	10 FEET
" REL DIR	48 PORT
SWELL HEIGHT	10 FEET
" REL DIR	48 PORT

---- VISUAL WEATHER / COMMENTS ----

OCAST /

MIDSHIP VERTICAL BENDING STRESS

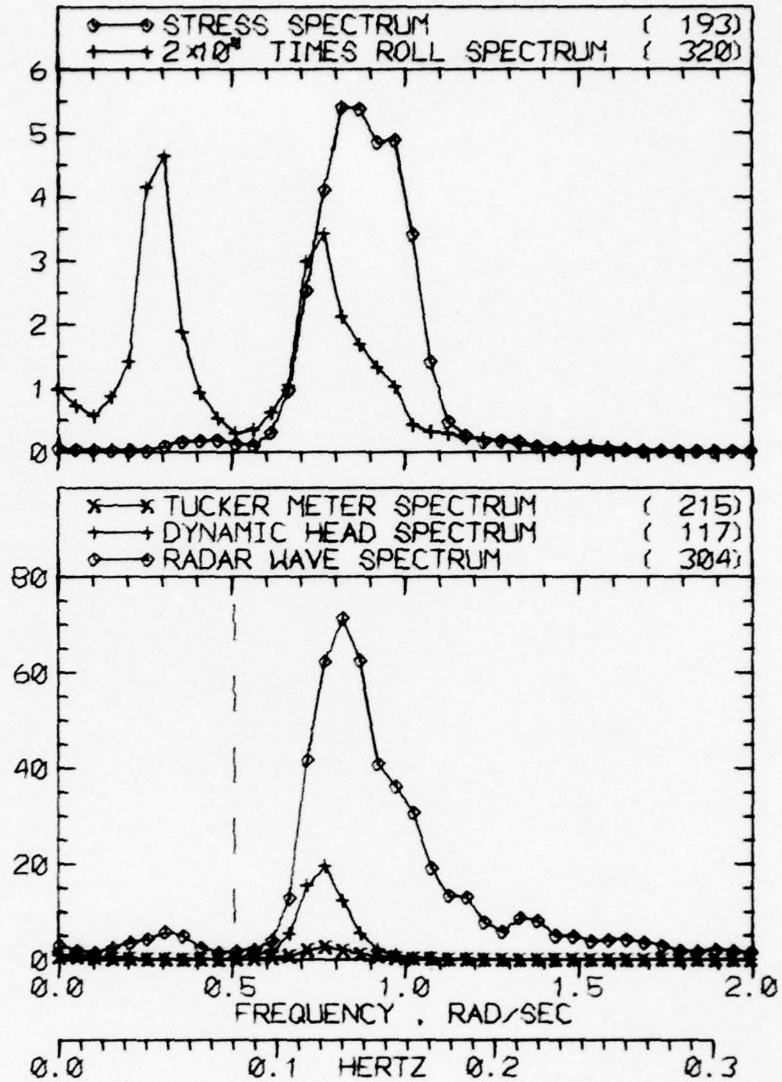
MAXIMUM PK-TR	9.4 KPSI
4.0 X RMS	5.5 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

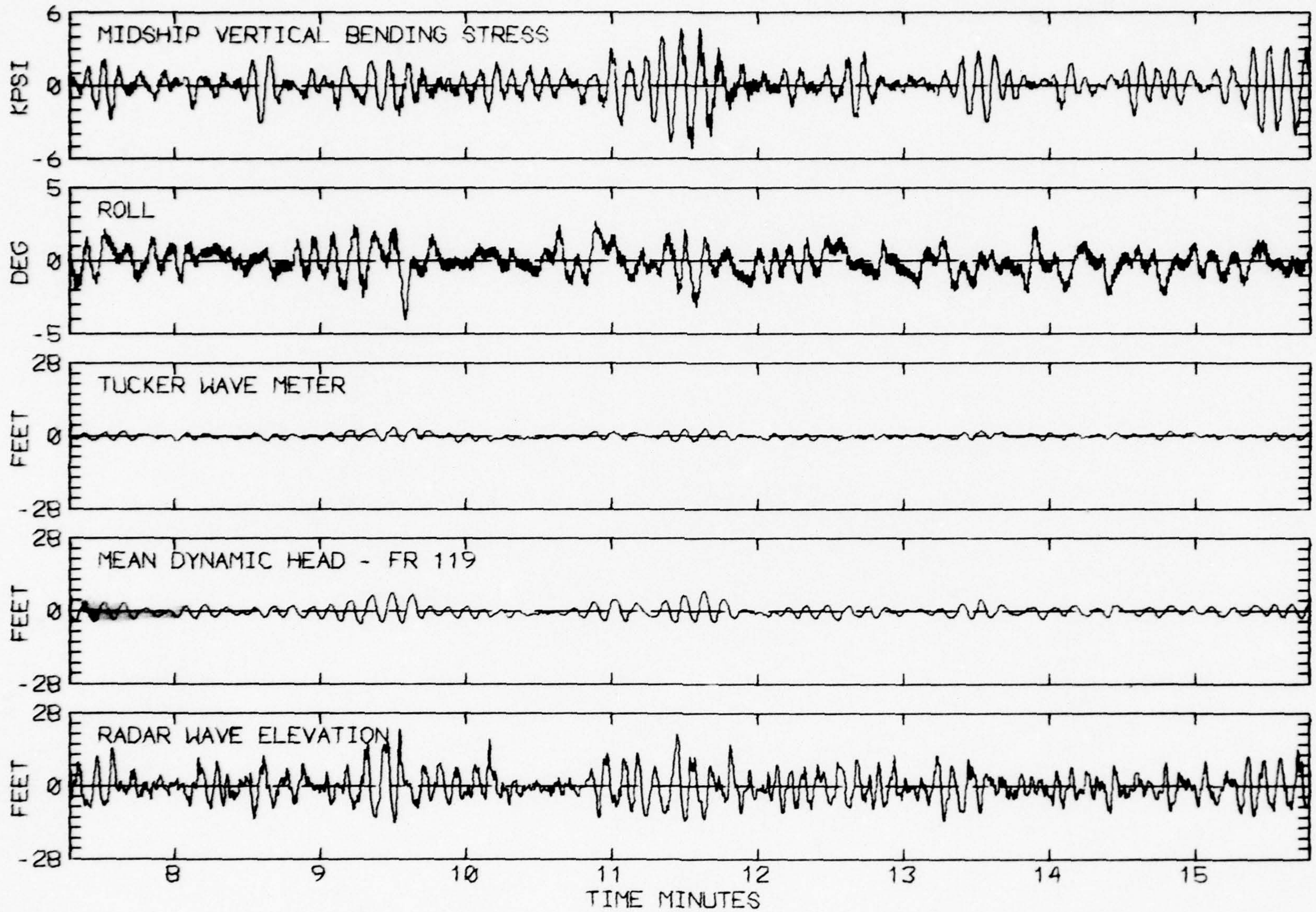
ROLL	3.9 DEG
PITCH	1.63 DEG
DK HSE VERT ACCEL	0.48 G
DK HSE LAT ACCEL	0.12 G
RADAR SLANT RANGE	32.6 FEET
VERTICAL RANGE	31.4 FEET
DISPL AT RADAR	23.8 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	284	138	274
MAXIMUM HEIGHT	5.2	11.8	33.4
10TH HIGHEST HTS	3.7	9.3	24.7
3RD HIGHEST HTS	2.5	7.1	18.9
4.0 RMS(SPECTRA)	3.5	7.6	21.2



RUN 2846 -- VOYAGE 61W -- TAPE 231 -- INDEX 28 -- INTERVAL 46



RUN 2846 -- VOYAGE 61W -- TAPE 231 -- INDEX 28 -- INTERVAL 46

LOG BOOK DATA	
DATE AND TIME	03-16-75 0400
POSITION	39-29 N 52-40 W
COURSE AND SPEED	273 . 16.3 KNOTS
SEA STATE	7
WAVE HEIGHT	20 FEET
" REL DIR	3 PORT
SWELL HEIGHT	20 FEET
" REL DIR	3 PORT

---- VISUAL WEATHER / COMMENTS ----

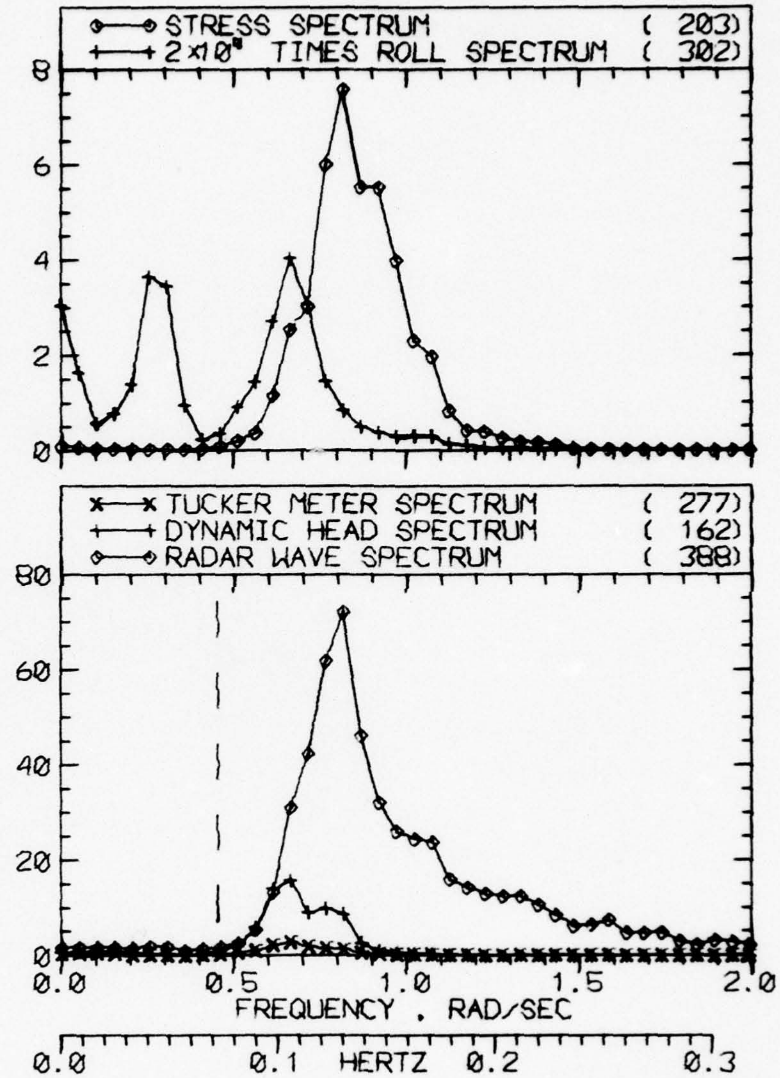
OCAST /

MIDSHIP VERTICAL BENDING STRESS	
MAXIMUM PK-TR	11.6 KPSI
4.0 X RMS	6.1 KPSI

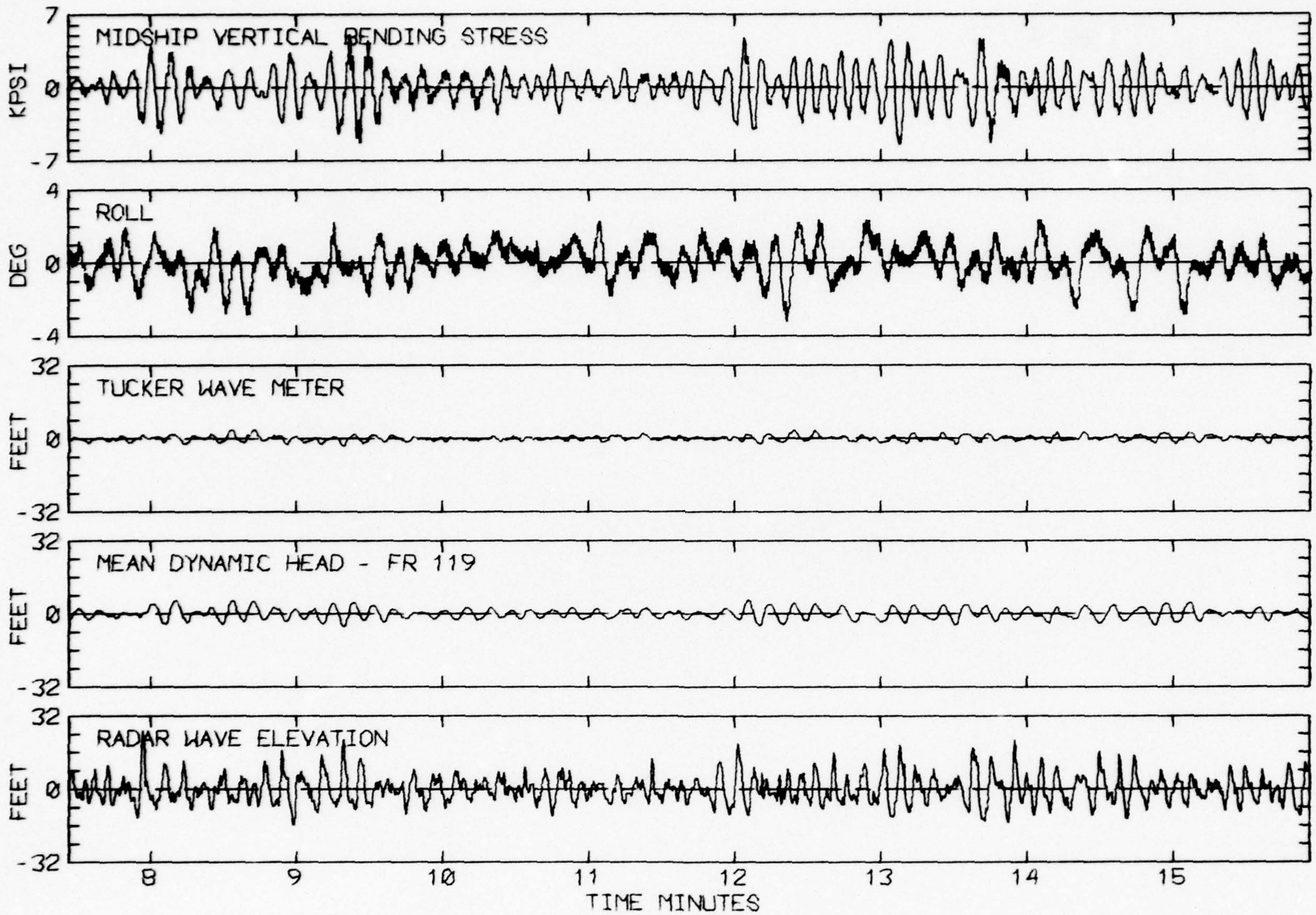
SUMMARY OF MOTIONS (4.0 X RMS)	
ROLL	3.7 DEG
PITCH	1.55 DEG
DK HSE VERT ACCEL	0.43 G
DK HSE LAT ACCEL	0.11 G
RADAR SLANT RANGE	36.0 FEET
VERTICAL RANGE	33.3 FEET
DISPL AT RADAR	21.7 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER	/DYN. HEAD	/RADAR
P-T SAMPLE SIZE	293	168	276
MAXIMUM HEIGHT	5.7	12.3	34.6
10TH HIGHEST HTS	4.0	9.1	26.8
3RD HIGHEST HTS	2.7	7.1	19.5
4.0 RMS(SPECTRA)	3.9	8.0	22.1



RUN 2849 -- VOYAGE 61W -- TAPE 231 -- INDEX 29 -- INTERVAL 49



RUN 2849 -- VOYAGE 61W -- TAPE 231 -- INDEX 29 -- INTERVAL 49

LOG BOOK DATA

DATE AND TIME	03-16-75 0800
POSITION	39-29 N 52-40 W
COURSE AND SPEED	270 . 17.1 KNOTS
SEA STATE	9
WAVE HEIGHT	20 FEET
" REL DIR	22 STBD
SWELL HEIGHT	20 FEET
" REL DIR	0

---- VISUAL WEATHER / COMMENTS ----

OCAST /

MIDSHIP VERTICAL BENDING STRESS

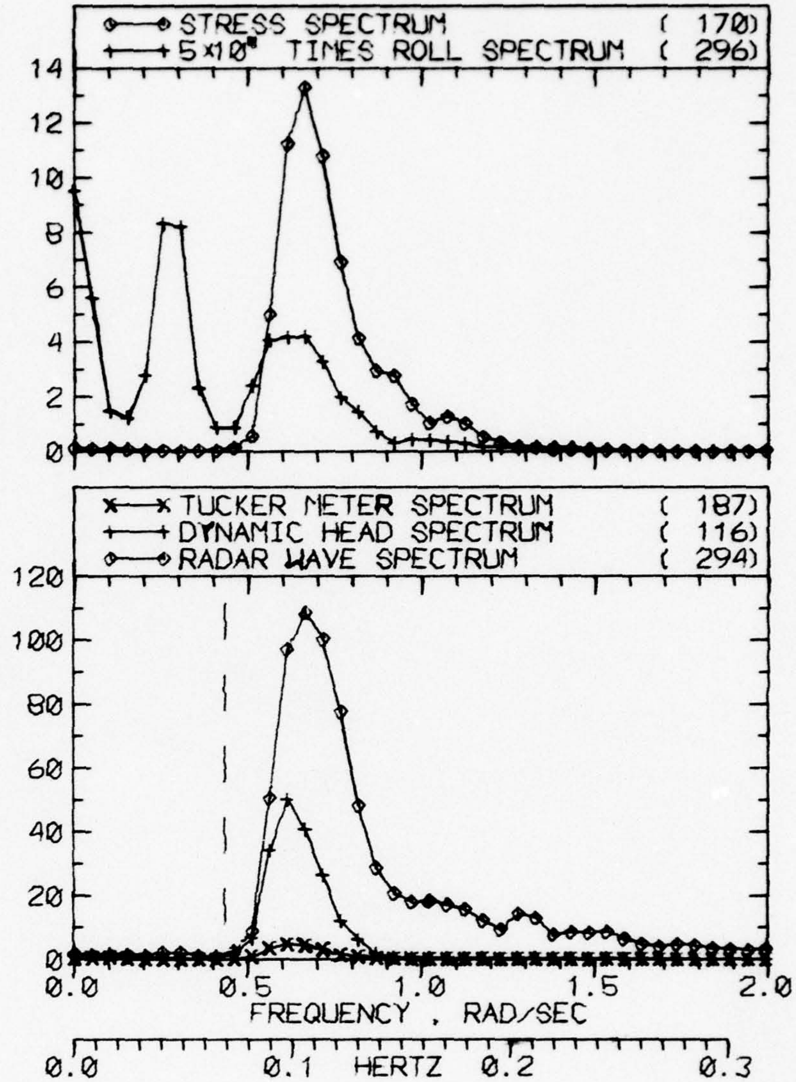
MAXIMUM PK-TR	15.3 KPSI
4.0 X RMS	7.4 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

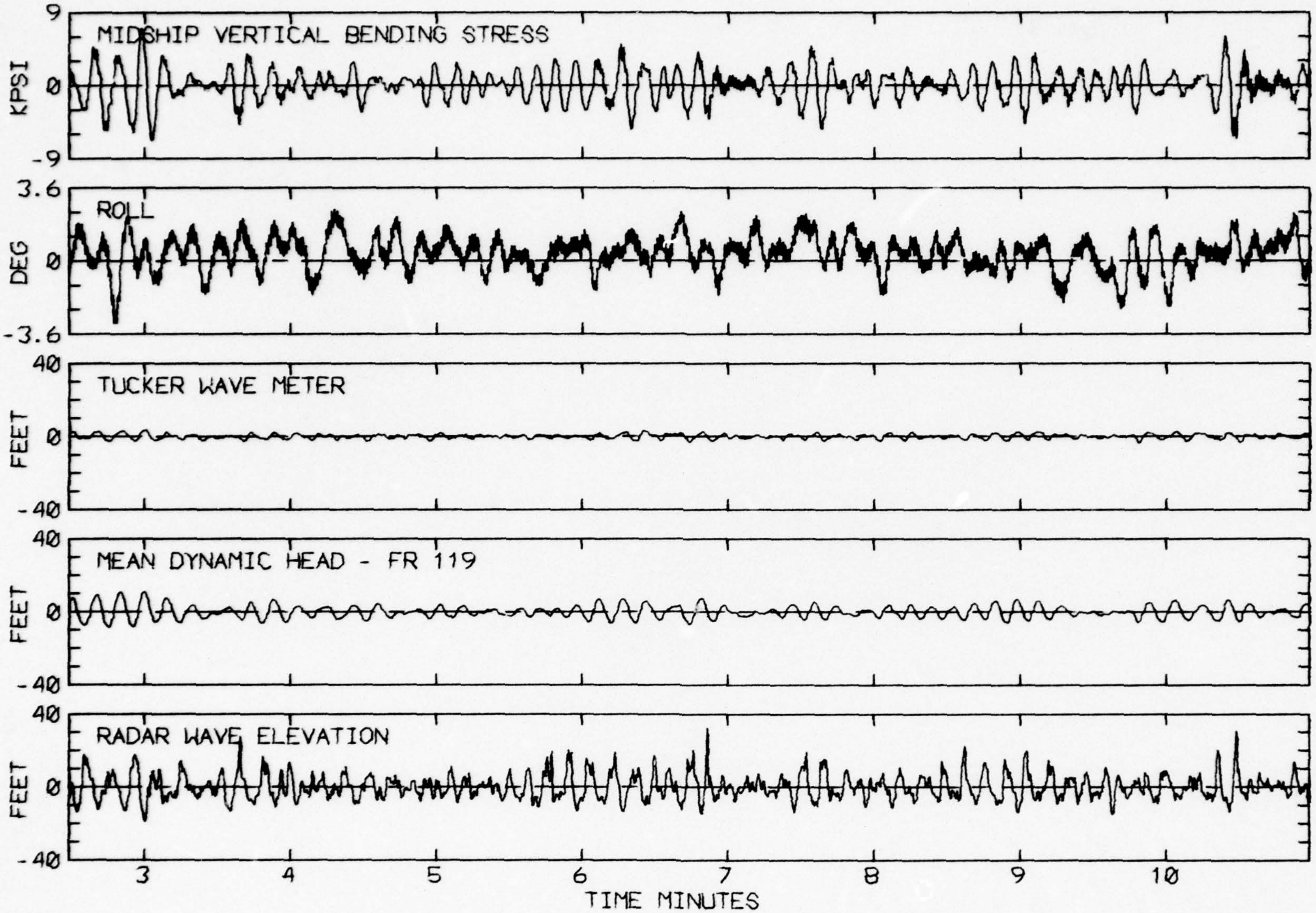
ROLL	3.4 DEG
PITCH	1.86 DEG
DK HSE VERT ACCEL	0.50 G
DK HSE LAT ACCEL	0.10 G
RADAR SLANT RANGE	42.1 FEET
VERTICAL RANGE	40.4 FEET
DISPL AT RADAR	31.6 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	222	109	241
MAXIMUM HEIGHT	6.8	19.1	40.9
10TH HIGHEST HTS	4.9	15.2	32.6
3RD HIGHEST HTS	3.6	12.3	23.4
4.0 RMS(SPECTRA)	4.6	12.5	25.9



RUN 2853 -- VOYAGE 61W -- TAPE 231 -- INDEX 30 -- INTERVAL 53



RUN 2853 -- VOYAGE 61W -- TAPE 231 -- INDEX 30 -- INTERVAL 53

LOG BOOK DATA	
DATE AND TIME	03-16-75 1400
POSITION	39-54 N 60-37 W
COURSE AND SPEED	270 . 17.1 KNOTS
SEA STATE	7
WAVE HEIGHT	15 FEET
" REL DIR	67 STBD
SWELL HEIGHT	15 FEET
" REL DIR	67 STBD

---- VISUAL WEATHER / COMMENTS ----

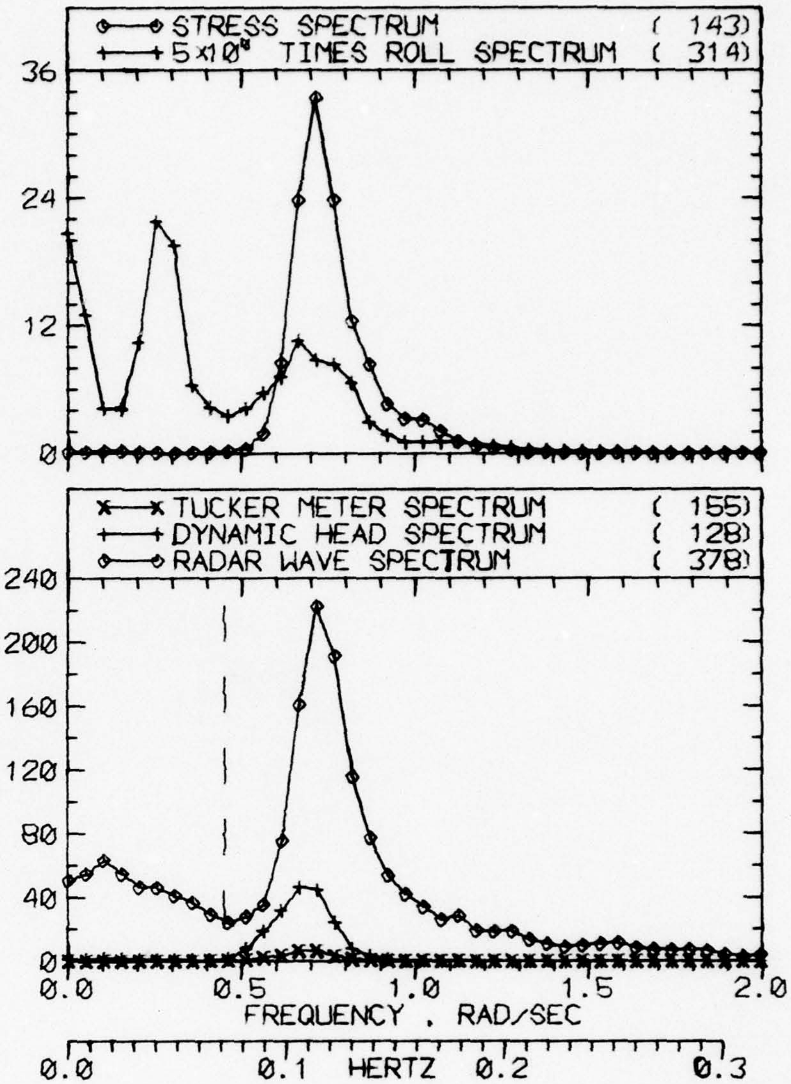
OCAST /

MIDSHIP VERTICAL BENDING STRESS	
MAXIMUM PK-TR	17.4 KPSI
4.0 X RMS	10.6 KPSI

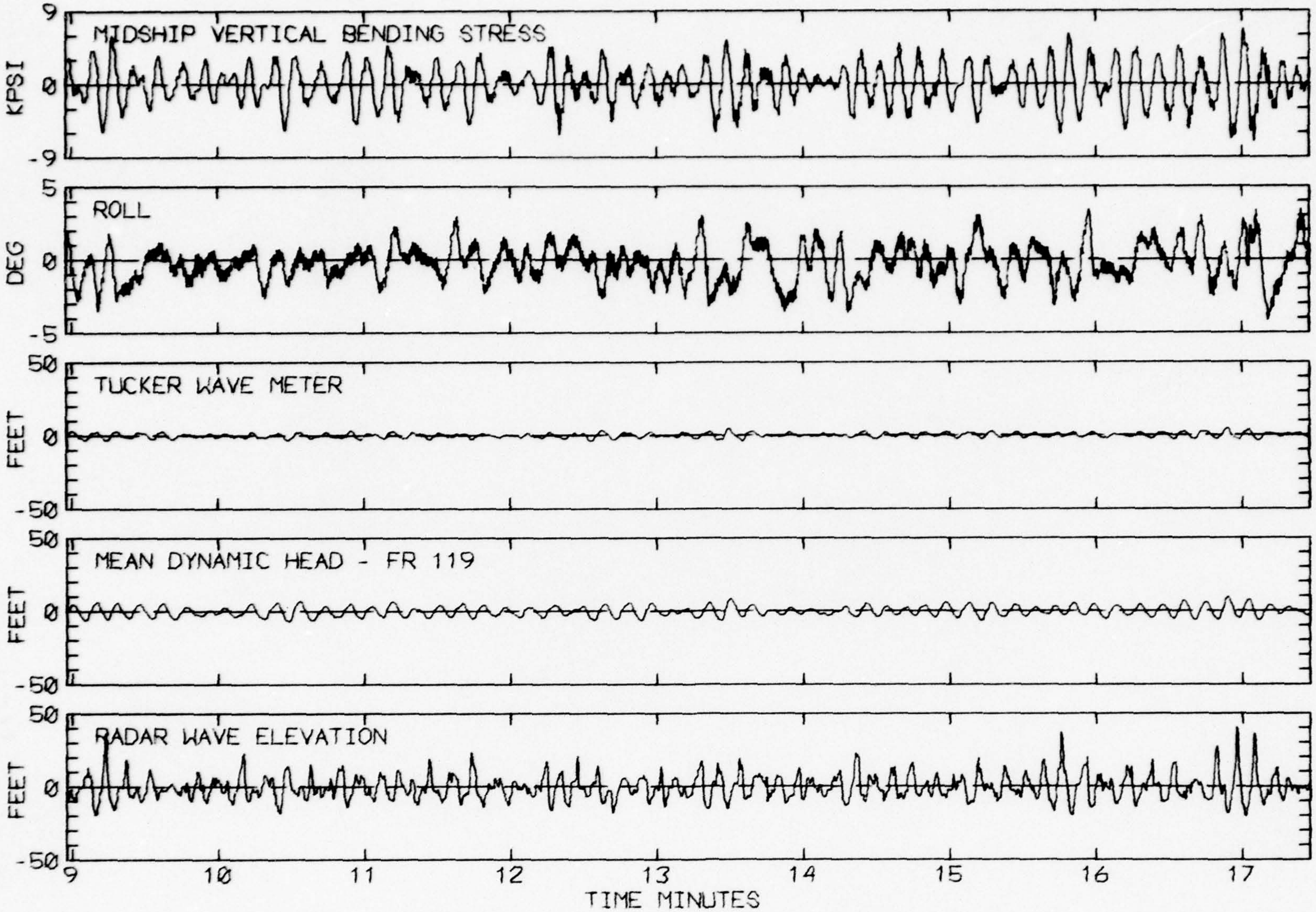
SUMMARY OF MOTIONS (4.0 X RMS)	
ROLL	5.3 DEG
PITCH	2.36 DEG
DK HSE VERT ACCEL	0.62 G
DK HSE LAT ACCEL	0.14 G
RADAR SLANT RANGE	61.8 FEET
VERTICAL RANGE	59.5 FEET
DISPL AT RADAR	36.7 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	225	117	222
MAXIMUM HEIGHT	7.8	23.4	61.2
10TH HIGHEST HTS	5.6	13.7	42.4
3RD HIGHEST HTS	3.9	11.6	31.0
4.0 RMS(SPECTRA)	5.0	12.8	38.2



RUN 2905 -- VOYAGE 61W -- TAPE 233 -- INDEX 32 -- INTERVAL 5



RUN 2905 -- VOYAGE 61W -- TAPE 233 -- INDEX 32 -- INTERVAL 5

LOG BOOK DATA	
DATE AND TIME	03-16-75 1400
POSITION	39-54 N 60-37 W
COURSE AND SPEED	270 . 17.1 KNOTS
SEA STATE	7
WAVE HEIGHT	15 FEET
" REL DIR	67 STBD
SWELL HEIGHT	15 FEET
" REL DIR	67 STBD

---- VISUAL WEATHER / COMMENTS ----

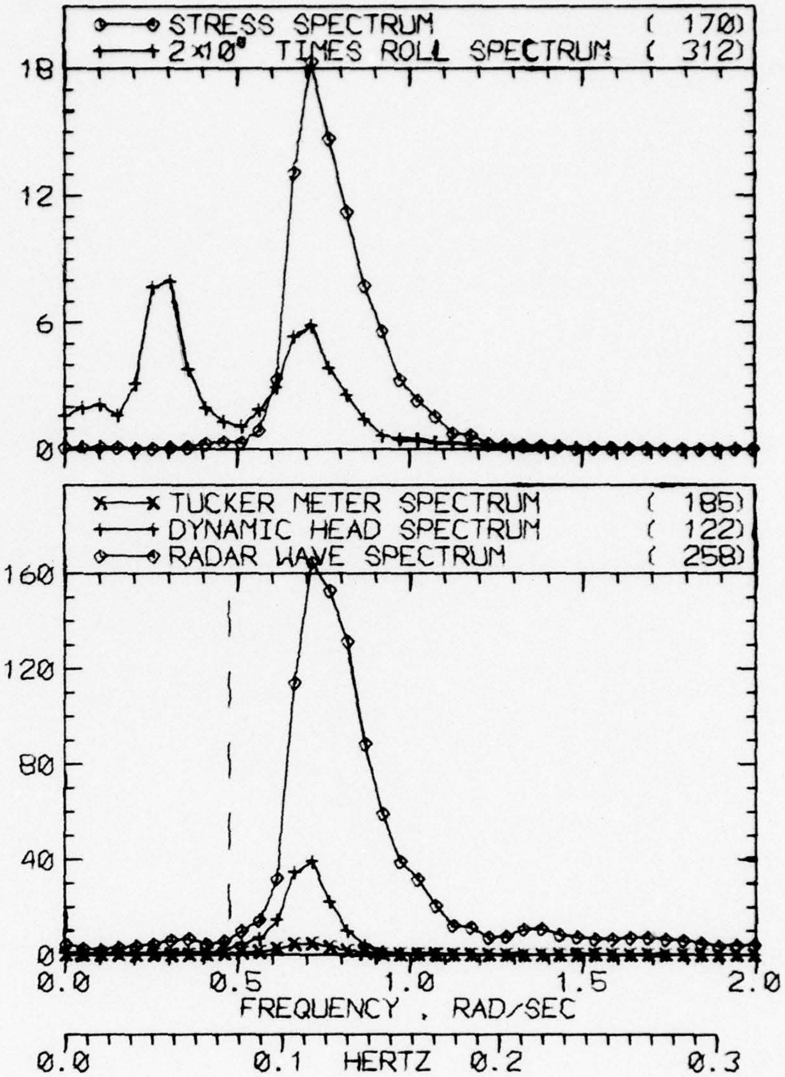
OCAST /

MIDSHIP VERTICAL BENDING STRESS	
MAXIMUM PK-TR	14.0 KPSI
4.0 X RMS	8.6 KPSI

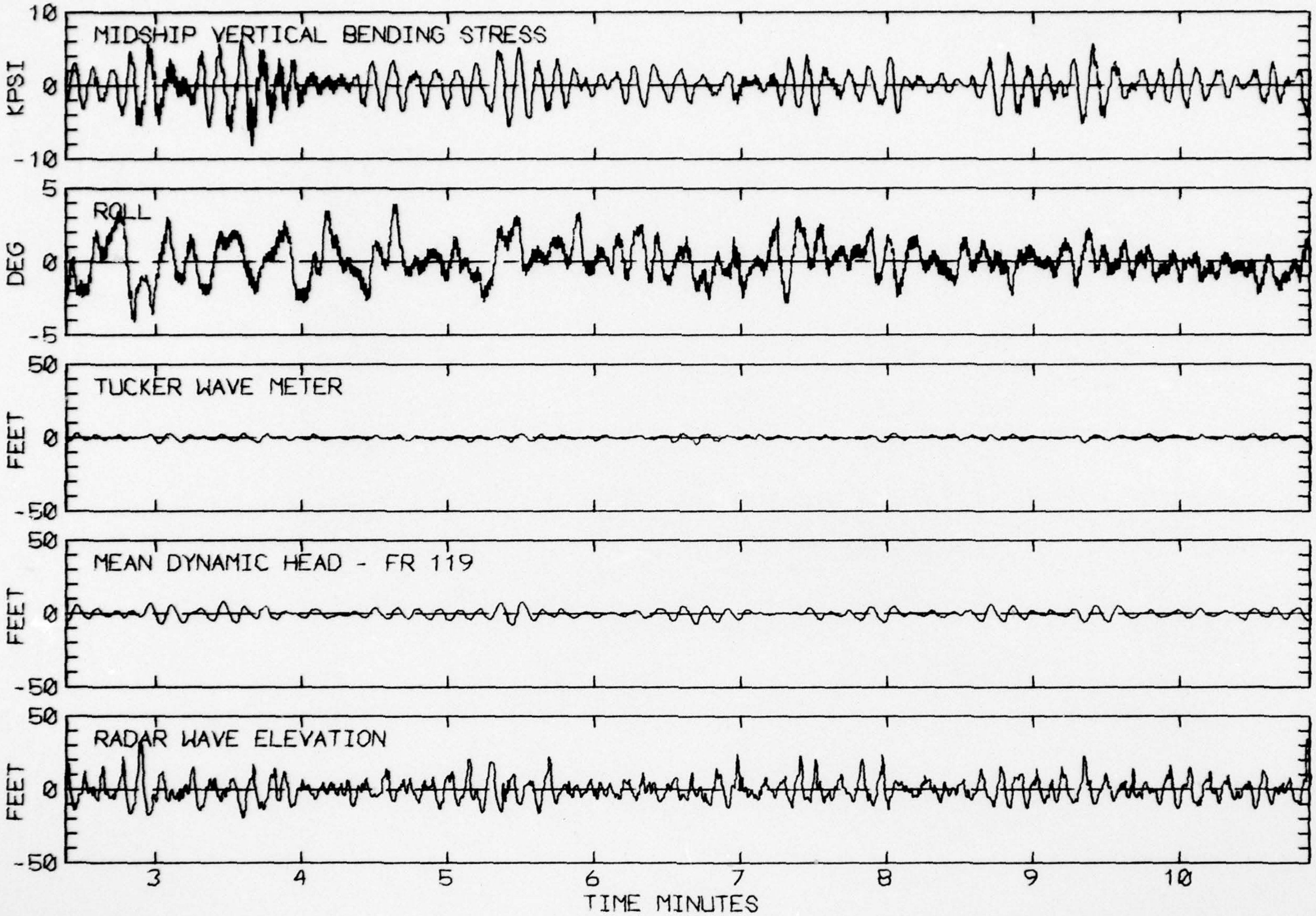
SUMMARY OF MOTIONS (4.0 X RMS)	
ROLL	5.1 DEG
PITCH	2.10 DEG
DK HSE VERT ACCEL	0.57 G
DK HSE LAT ACCEL	0.13 G
RADAR SLANT RANGE	52.1 FEET
VERTICAL RANGE	52.0 FEET
DISPL AT RADAR	33.1 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/	DYN. HEAD/	RADAR
P-T SAMPLE SIZE	253	139	214
MAXIMUM HEIGHT	7.5	15.4	50.3
10TH HIGHEST HTS	5.1	12.9	36.9
3RD HIGHEST HTS	3.5	10.3	28.8
4.0 RMS(SPECTRA)	4.6	11.0	30.3



RUN 2906 -- VOYAGE 61W -- TAPE 233 -- INDEX 32 -- INTERVAL 6



RUN 2906 -- VOYAGE 61W -- TAPE 233 -- INDEX 32 -- INTERVAL 6

LOG BOOK DATA	
DATE AND TIME	03-16-75 1600
POSITION	39-54 N 60-37 W
COURSE AND SPEED	270 , 17.1 KNOTS
SEA STATE	6
WAVE HEIGHT	10 FEET
" REL DIR	67 STBD
SWELL HEIGHT	10 FEET
" REL DIR	67 STBD

---- VISUAL WEATHER / COMMENTS ----

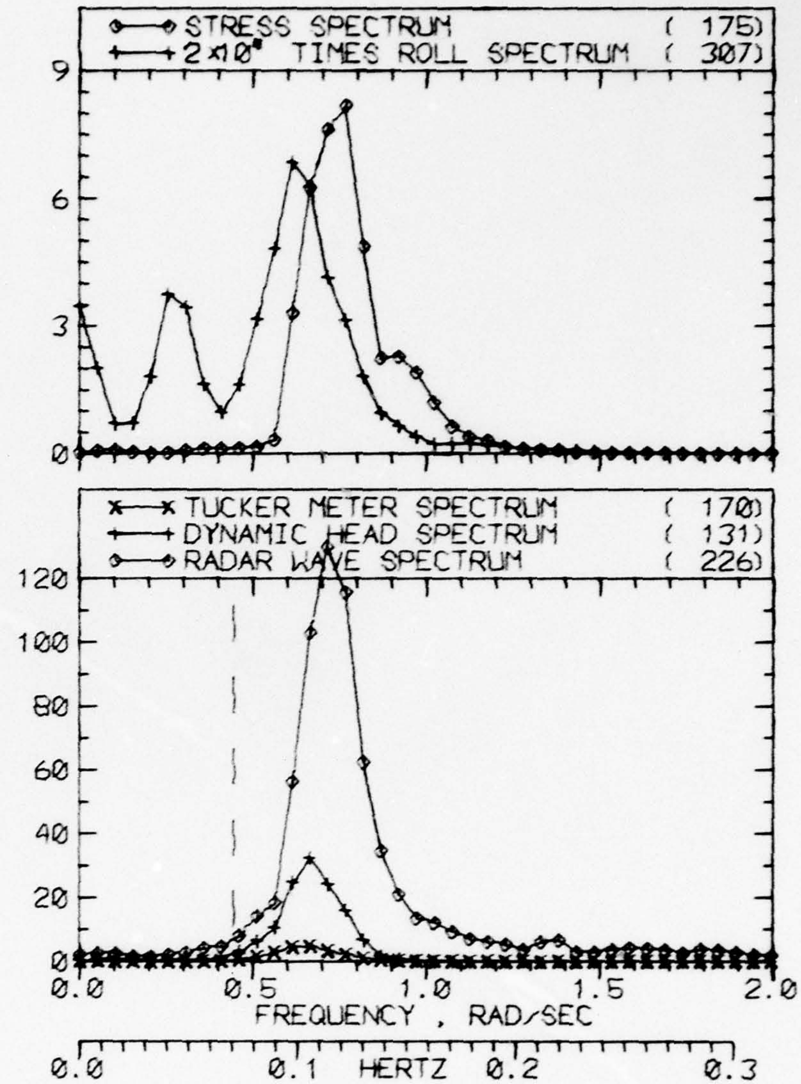
PT CLDY /

MIDSHIP VERTICAL BENDING STRESS	
MAXIMUM PK-TR	10.2 KPSI
4.0 X RMS	6.0 KPSI

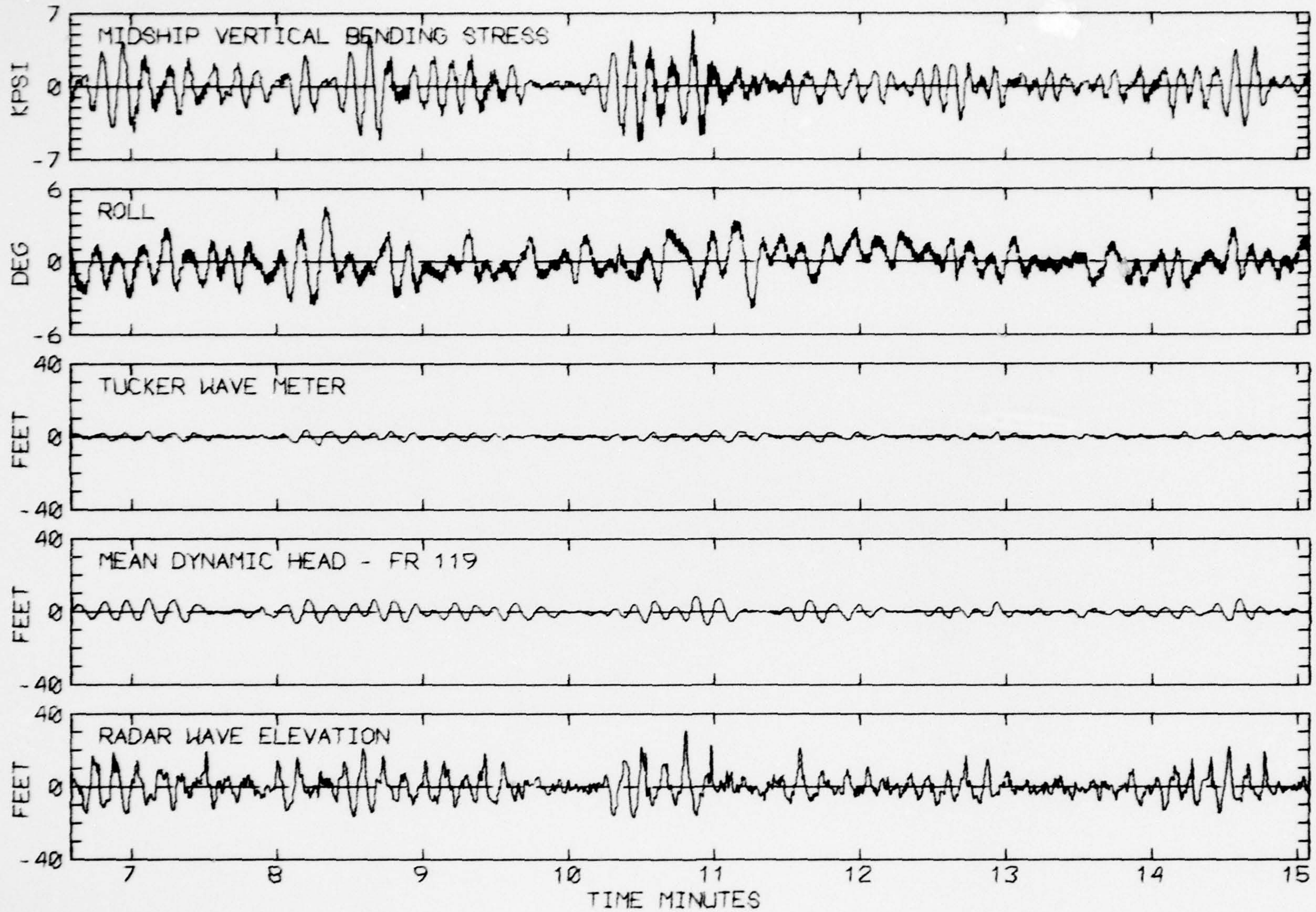
SUMMARY OF MOTIONS (4.0 X RMS)	
ROLL	4.8 DEG
PITCH	1.86 DEG
DK HSE VERT ACCEL	0.50 G
DK HSE LAT ACCEL	0.12 G
RADAR SLANT RANGE	44.0 FEET
VERTICAL RANGE	43.0 FEET
DISPL AT RADAR	28.9 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	234	137	252
MAXIMUM HEIGHT	7.9	15.8	47.1
10TH HIGHEST HTS	5.0	12.2	31.6
3RD HIGHEST HTS	3.4	9.8	22.1
4.0 RMS(SPECTRA)	4.5	10.5	25.0



RUN 2911 -- VOYAGE 61W -- TAPE 233 -- INDEX 33 -- INTERVAL 11



RUN 2911 -- VOYAGE 61W -- TAPE 233 -- INDEX 33 -- INTERVAL 11

LOG BOOK DATA	
DATE AND TIME	03-16-75 1800
POSITION	39-54 N 60-37 W
COURSE AND SPEED	270 . 17.1 KNOTS
SEA STATE	6
WAVE HEIGHT	10 FEET
" REL DIR	67 STBD
SWELL HEIGHT	10 FEET
" REL DIR	67 STBD

---- VISUAL WEATHER / COMMENTS ----

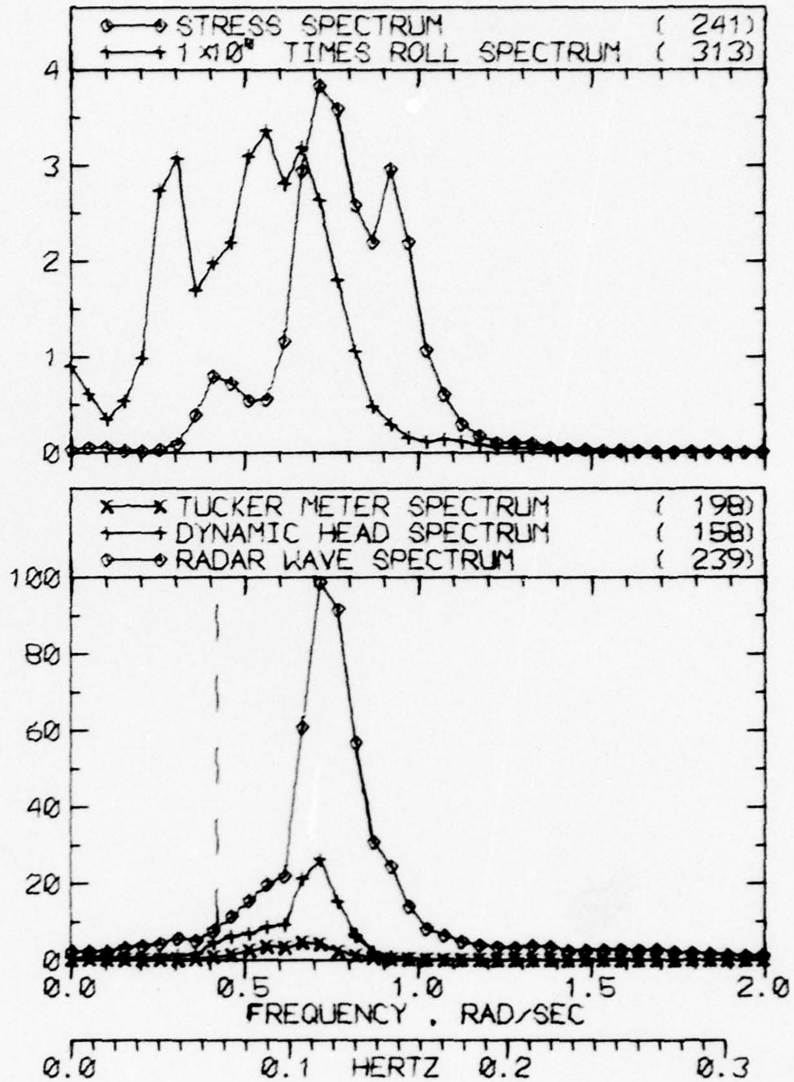
PT CLDY /

MIDSHIP VERTICAL BENDING STRESS	
MAXIMUM PK-TR	8.7 KPSI
4.0 X RMS	4.8 KPSI

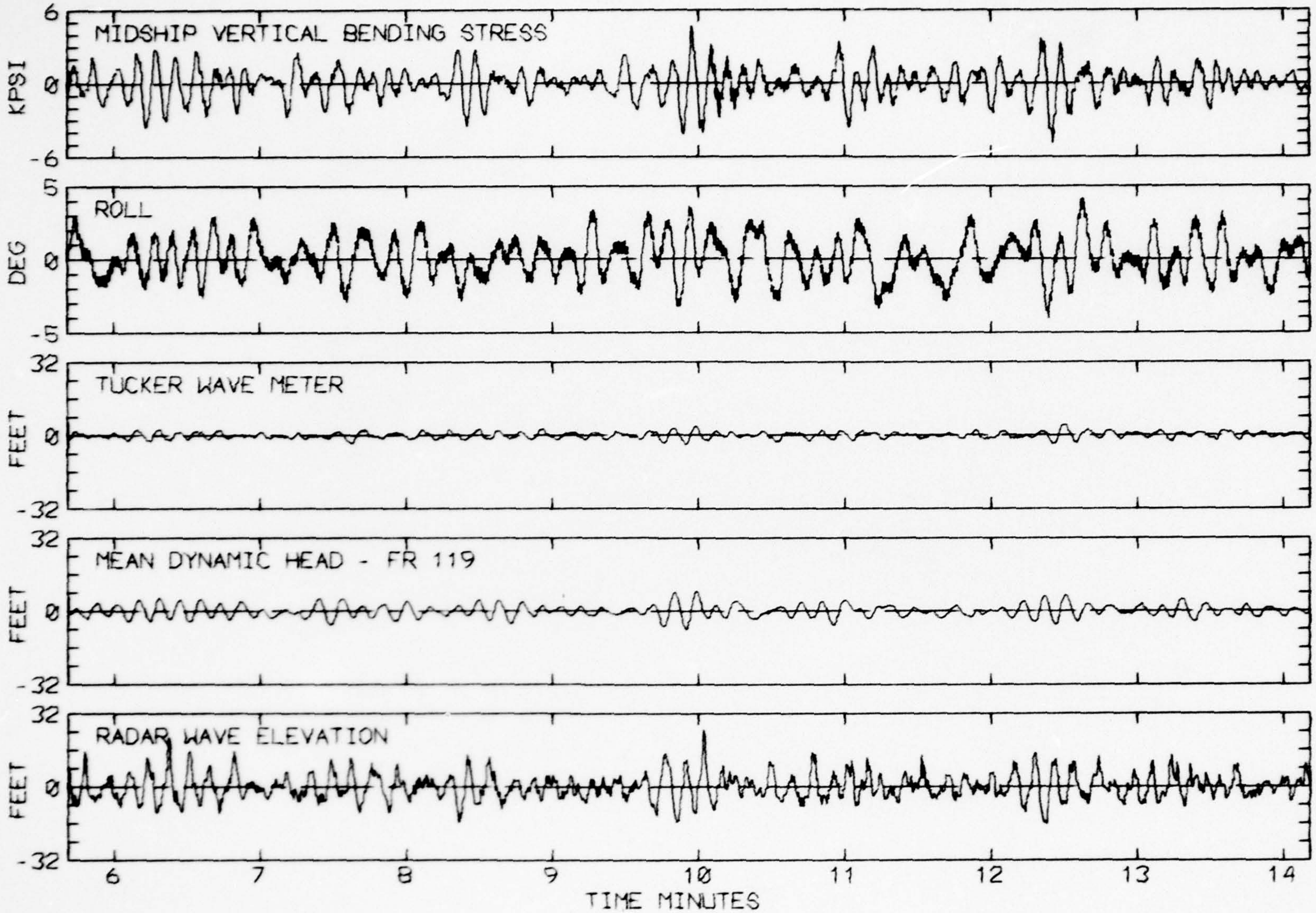
SUMMARY OF MOTIONS (4.0 X RMS)		
ROLL	5.4	DEG
PITCH	1.65	DEG
DK HSE VERT ACCEL	0.46	G
DK HSE LAT ACCEL	0.14	G
RADAR SLANT RANGE	38.9	FEET
VERTICAL RANGE	37.4	FEET
DISPL AT RADAR	26.6	FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	210	118	275
MAXIMUM HEIGHT	7.8	15.6	35.1
10TH HIGHEST HTS	5.0	11.3	25.2
3RD HIGHEST HTS	3.7	9.2	18.1
4.0 RMS(SPECTRA)	4.8	9.7	21.9



RUN 2914 -- VOYAGE 61W -- TAPE 233 -- INDEX 34 -- INTERVAL 14



RUN 2914 -- VOYAGE 61W -- TAPE 233 -- INDEX 34 -- INTERVAL 14

LOG BOOK DATA	
DATE AND TIME	03-16-75 2000
POSITION	39-54 N 60-37 W
COURSE AND SPEED	270 , 17.6 KNOTS
SEA STATE	5
WAVE HEIGHT	10 FEET
" REL DIR	67 STBD
SWELL HEIGHT	10 FEET
" REL DIR	67 STBD

---- VISUAL WEATHER / COMMENTS ----

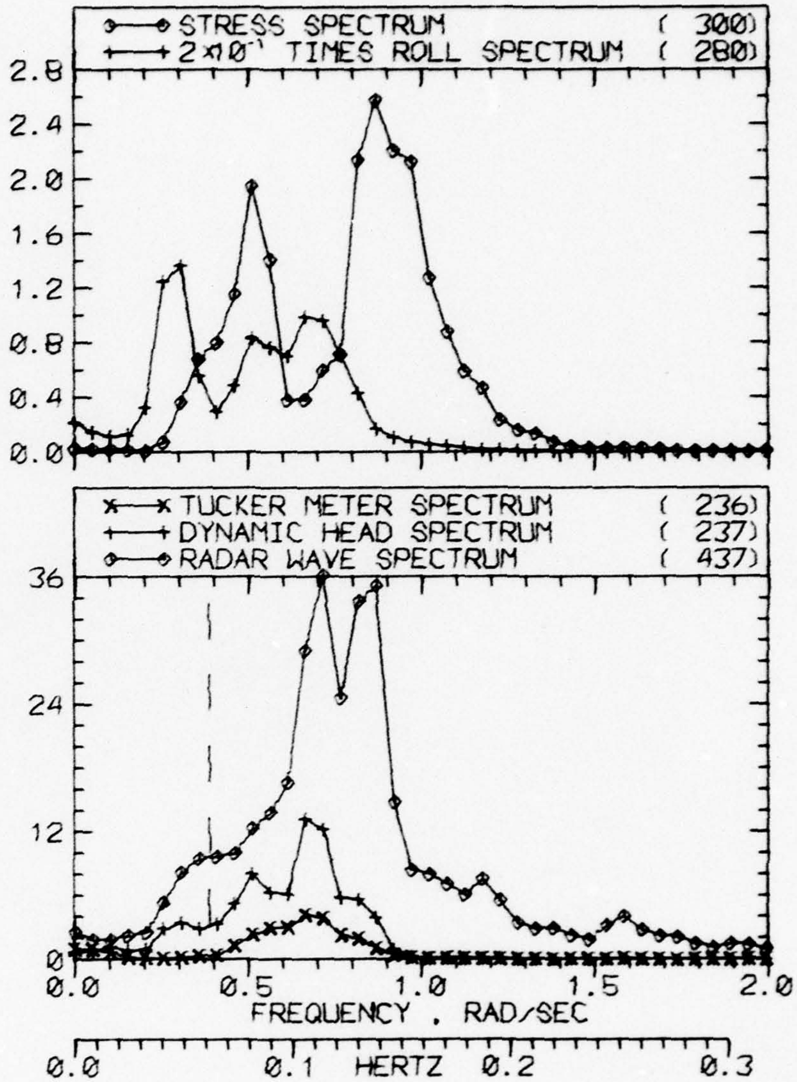
PT CLDY / END MANUAL RECORD

MIDSHIP VERTICAL BENDING STRESS	
MAXIMUM PK-TR	6.5 KPSI
4.0 X RMS	4.3 KPSI

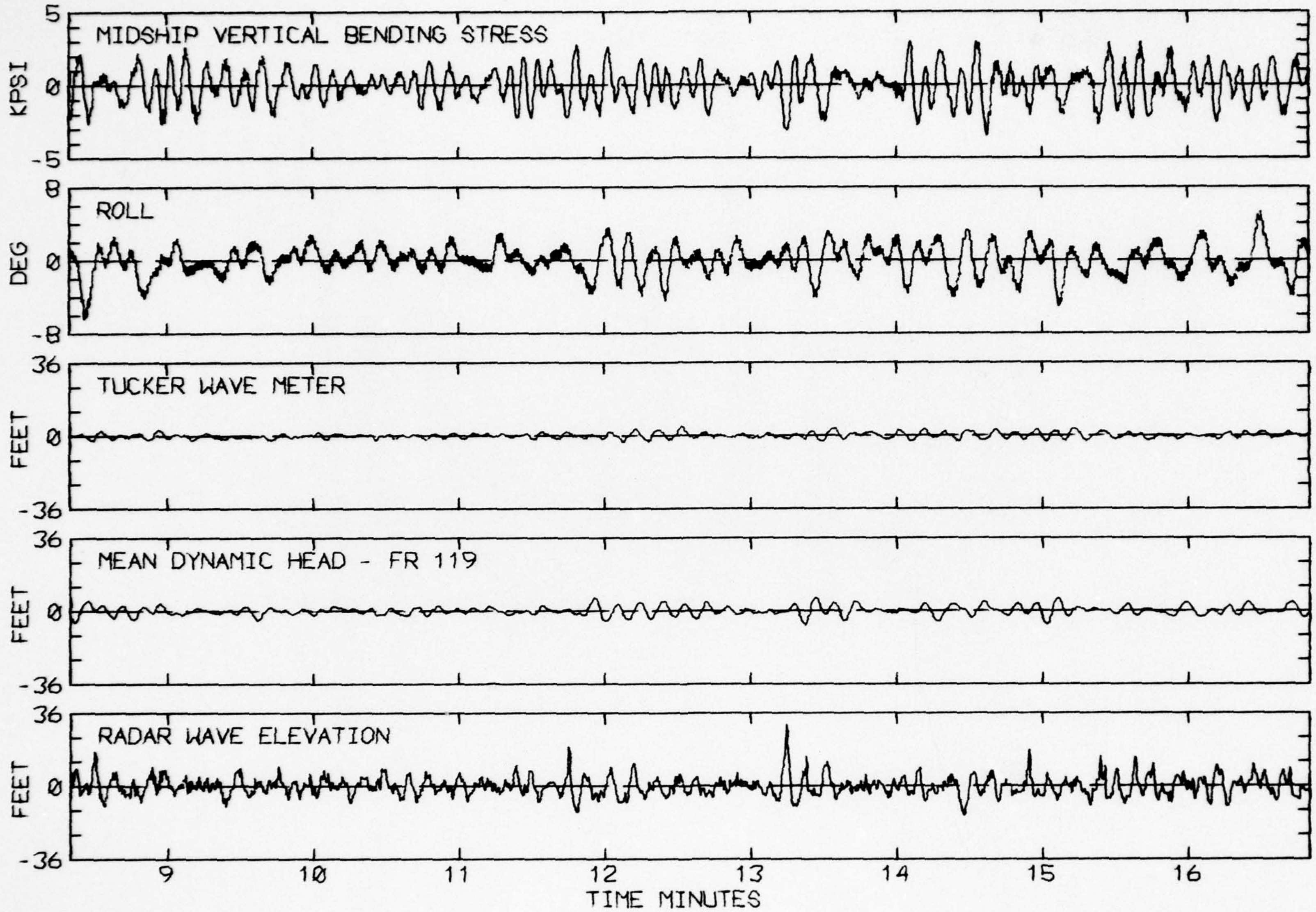
SUMMARY OF MOTIONS (4.0 X RMS)	
ROLL	6.7 DEG
PITCH	1.38 DEG
DK HSE VERT ACCEL	0.40 G
DK HSE LAT ACCEL	0.15 G
RADAR SLANT RANGE	31.1 FEET
VERTICAL RANGE	29.3 FEET
DISPL AT RADAR	22.1 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	223	140	300
MAXIMUM HEIGHT	7.0	11.6	40.9
10TH HIGHEST HTS	5.3	9.6	20.6
3RD HIGHEST HTS	3.6	7.6	14.3
4.0 RMS(SPECTRA)	4.9	8.4	17.8



RUN 2918 -- VOYAGE 61W -- TAPE 233 -- INDEX 35 -- INTERVAL 18



RUN 2918 -- VOYAGE 61W -- TAPE 233 -- INDEX 35 -- INTERVAL 18

LOG BOOK DATA	
DATE AND TIME	03-16-75 2400
POSITION	39-54 N 60-37 W
COURSE AND SPEED	270 , 18.0 KNOTS
SEA STATE	4
WAVE HEIGHT	6 FEET
" REL DIR	67 STBD
SWELL HEIGHT	6 FEET
" REL DIR	67 STBD

---- VISUAL WEATHER / COMMENTS ----

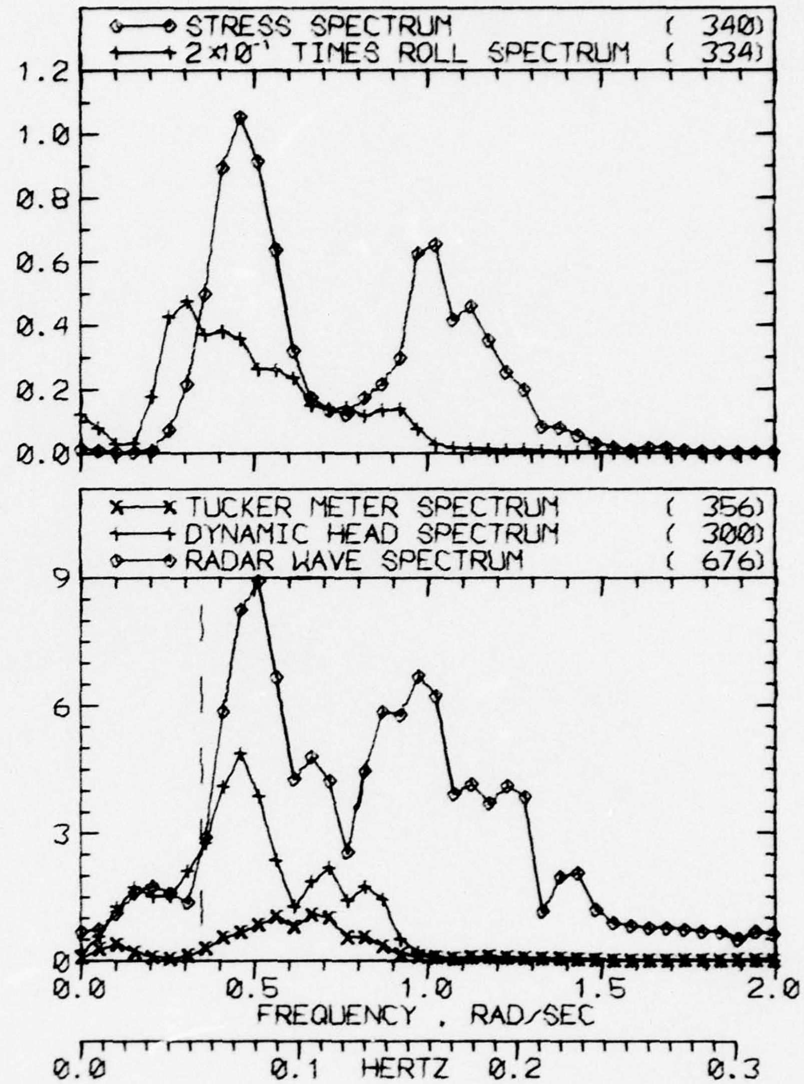
PT CLDY /

MIDSHIP VERTICAL BENDING STRESS	
MAXIMUM PK-TR	4.0 KPSI
4.0 X RMS	2.8 KPSI

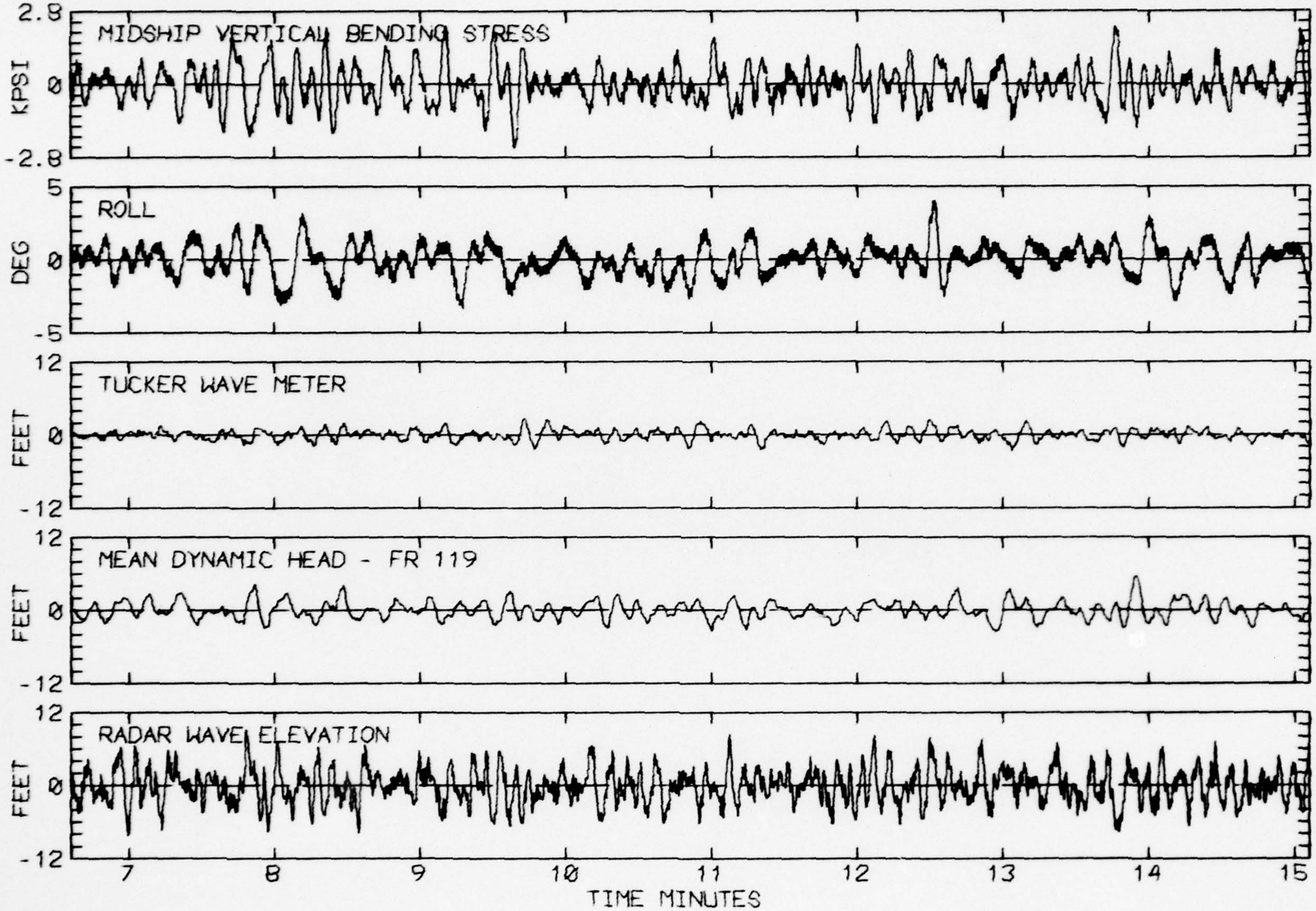
SUMMARY OF MOTIONS (4.0 X RMS)	
ROLL	4.3 DEG
PITCH	0.97 DEG
DK HSE VERT ACCEL	0.25 G
DK HSE LAT ACCEL	0.12 G
RADAR SLANT RANGE	16.0 FEET
VERTICAL RANGE	15.1 FEET
DISPL AT RADAR	13.0 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	378	153	469
MAXIMUM HEIGHT	5.1	8.2	15.7
10TH HIGHEST HTS	2.9	5.9	10.6
3RD HIGHEST HTS	1.9	4.3	7.4
4.0 RMS(SPECTRA)	3.0	5.6	10.8



RUN 2921 -- VOYAGE 61W -- TAPE 233 -- INDEX 36 -- INTERVAL 21



RUN 2921 -- VOYAGE 61W -- TAPE 233 -- INDEX 36 -- INTERVAL 21

LOG BOOK DATA

DATE AND TIME	03-17-75 0400
POSITION	39-54 N 60-37 W
COURSE AND SPEED	270 , 17.2 KNOTS
SEA STATE	3
WAVE HEIGHT	2 FEET
" REL DIR	67 STBD
SWELL HEIGHT	2 FEET
" REL DIR	67 STBD

---- VISUAL WEATHER / COMMENTS ----

PT CLDY /

MIDSHIP VERTICAL BENDING STRESS

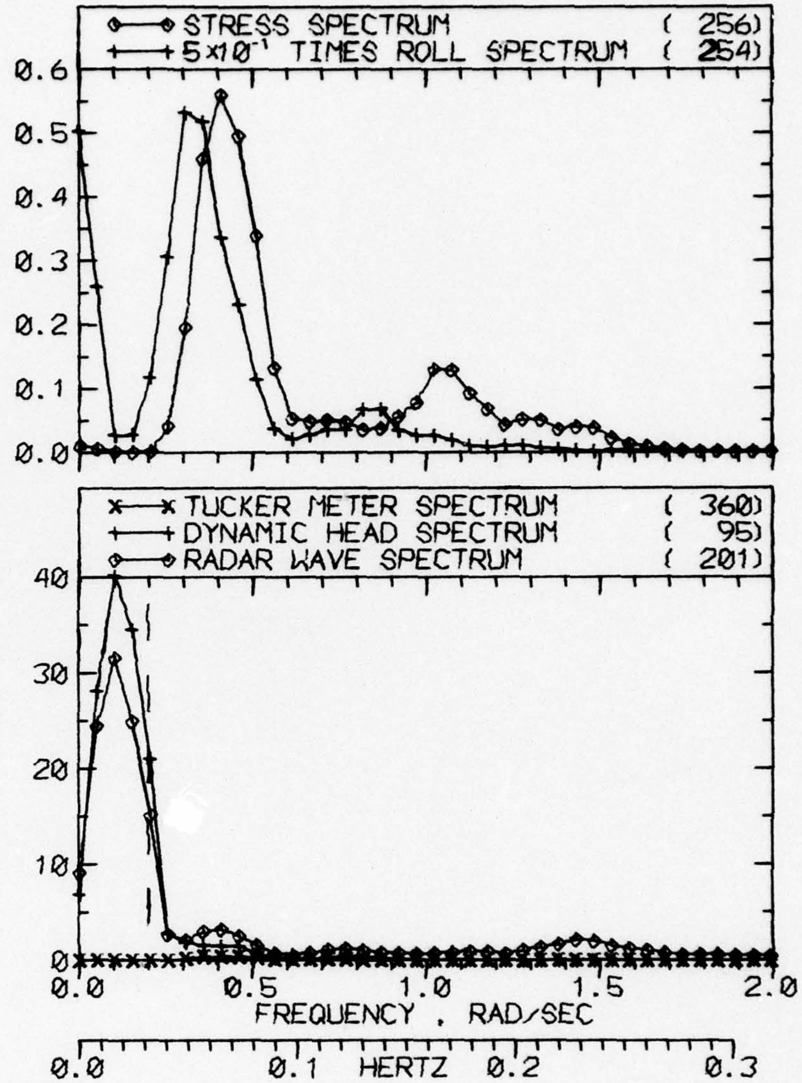
MAXIMUM PK-TR	2.9 KPSI
4.0 X RMS	1.7 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

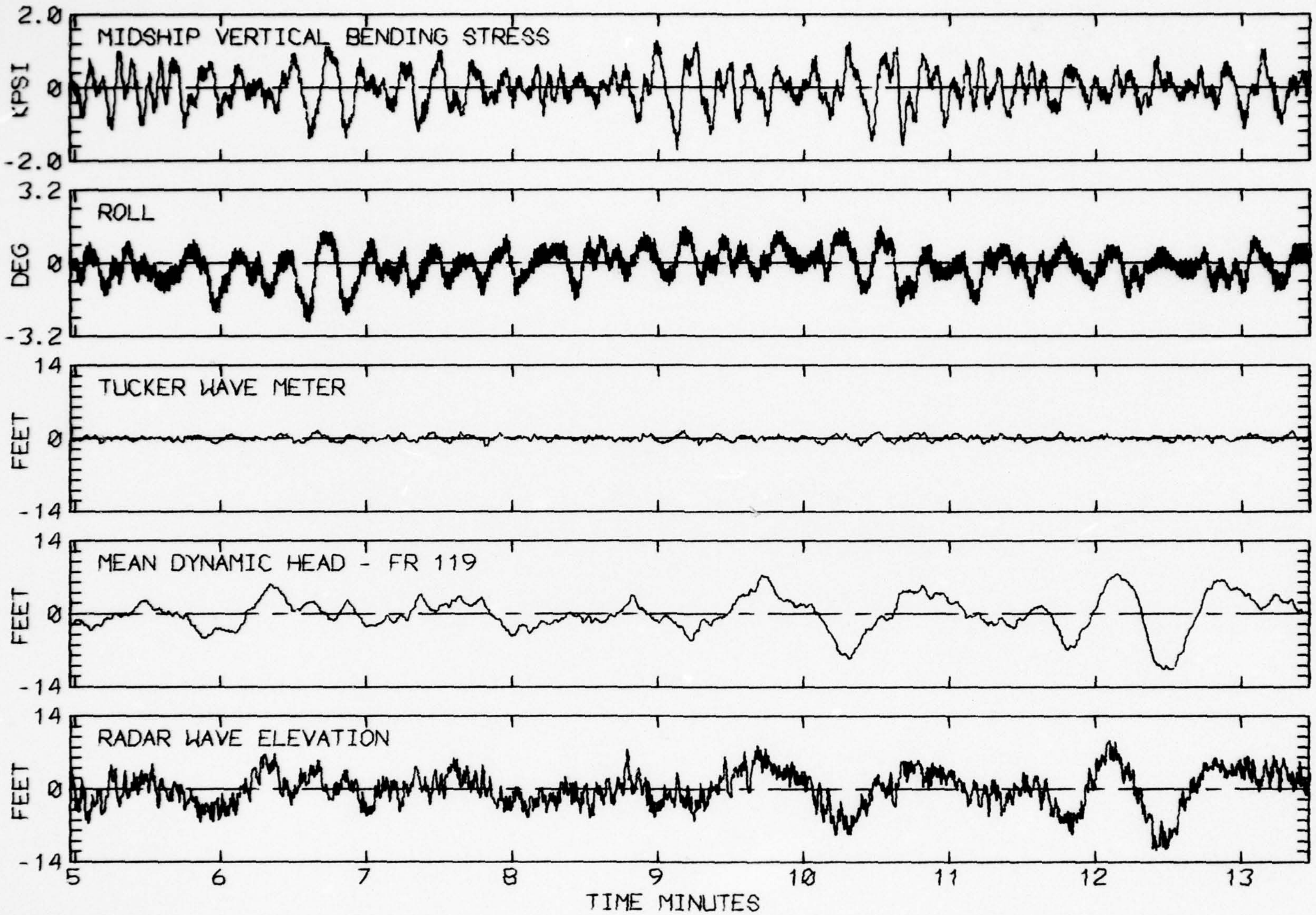
ROLL	2.6 DEG
PITCH	0.74 DEG
DK HSE VERT ACCEL	0.15 G
DK HSE LAT ACCEL	0.09 G
RADAR SLANT RANGE	9.1 FEET
VERTICAL RANGE	8.6 FEET
DISPL AT RADAR	11.2 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	674	93	439
MAXIMUM HEIGHT	2.1	18.6	10.3
10TH HIGHEST HTS	1.3	9.0	7.6
3RD HIGHEST HTS	0.9	5.2	6.0
4.0 RMS(SPECTRA)	1.7	10.7	11.5



RUN 2925 -- VOYAGE 61W -- TAPE 233 -- INDEX 37 -- INTERVAL 25



RUN 2925 -- VOYAGE 61W -- TAPE 233 -- INDEX 37 -- INTERVAL 25

APPENDIX

THE DATA REDUCTION AND PRESENTATION PROCEDURE ACCORDING TO THE DEVELOPMENT IN REFERENCE 4

The data reduction procedure for each interval involved:

a. Four main computation programs, the last one of which produced a complete file of results for each interval.

b. Two lister programs to supply immediate indications of some of the results.

c. One file consolidation program which produced one file for each voyage leg containing everything but the time histories of radar wave and mean dynamic head.

d. Two programs to generate the final graphical presentations for each interval.

Items b through d amount to bookkeeping operations. The work was done in the four main computation programs.

The first computation program carried out the procedure described in Reference 4 for the radar. At its conclusion the radar wave spectrum and the computed time history were written in temporary files as was the time history of vertical displacement at the radar.

The second program involved reduction of the Tucker data. Both the original data and the displacement file produced by the first program were accessed. The procedure was carried out so that time histories of mean dynamic head and the Tucker Meter signal were available. These were spectrum analyzed, and all results written in a temporary file.

The third computation program accessed the various wave-related time histories (radar, Tucker, and mean dynamic head) and performed a peak-trough analysis on the middle 16-1/2 minutes of each. (Because of the tapering described in Reference 4 both the radar and mean dynamic head data are not valid for the first and last two minutes of sample.) The object of the peak-trough analysis was to produce double amplitude statistics. The zero crossing convention was used; that is, a crest was defined as the largest instantaneous value in an excursion above the sample mean, a trough was the smallest instantaneous value in an excursion below the sample mean. The double amplitude is the difference in elevation between crest and succeeding trough. In this approach small fluctuations are more or less ignored if they are riding on top of large ones. The results resemble the double amplitudes which would be estimated by hand from an oscillograph record except that the hand analyst would probably visually fair through superimposed noise whereas the computer does not. The effect is that while the computer gets about the same number of double amplitudes as the human analyst, the computer's answers tend to be higher if the records are noisy. From the double amplitudes found, the average of 1/3 and 1/10 highest were computed, and the position in the sample of the largest double amplitude was noted. All results, including the actual double amplitudes were written in a temporary file.

The fourth computation program accessed the original data and performed spectrum analyses upon the midship vertical bending stress and roll. It then accessed all previously written temporary files and produced a new file containing all of the results for the interval. These results included log-book data, results of the first analysis of raw data (Ref.3,5), five spectra along with all analysis parameters, all results from the peak-trough analysis, and the two new time histories, the radar wave and the mean dynamic head. These files were meant to be stored on magnetic tape for possible future reference.

The final presentation of results for each interval is contained on two charts. The first type of chart (which appears on the even numbered pages of this report) contains the scalar spectra and a tabulation of results. The second type of chart (odd numbered pages) involves sample time histories. Both are identified at the bottom with the DL run number, the voyage number, the analog tape and interval numbers, and the index number assigned by Teledyne.

Referring to any even page, the tabulation at the left is intended as a summary of the most significant numbers pertaining to the interval. At the top is as much of the original log-book data as it seemed reasonable to squeeze in. This includes date, time, position, and ship speed, as well as the visual estimates of wave and swell heights and directions. Directions are counted from the bow to port or starboard in degrees. The "sea state" is apparently the Beaufort wind. The final line in the first section of the tabulation includes comments on visual weather and, after the slash, any other comment appearing in the log.

The second box in the tabulation involves midship longitudinal stress results. Only two of the many numbers which are available could be included as indices. The first is the maximum peak to trough stress excursion as obtained in Reference 1 or 2. The second index is the significant stress (4 times rms) as derived from the area of the stress spectrum obtained in the present reduction.

The third box in the tabulation is a summary of motions. Again the "significant" motions (4 rms) are indicated. The value for roll was derived from spectrum area, that for pitch and accelerations from the rms of the basic data. (Unless there are significant linear trends in the data the differences are slight between "raw" and "spectrum" rms.) The last three items in the list involve various stages in the radar data reduction. The first is the slant range as recorded. The "vertical range is $R_c(t)$ of the radar analysis. This entry is essentially the vertical component of the range relative to the position of the accelerometer package. The number was derived from the spectrum. The last entry is the significant displacement at the radar (significant doubly integrated acceleration). It too was derived from spectrum analyses.

In a sense, the table at the bottom of the tabulation contains the final numerical answers. Items in the first column pertain to the uncorrected Tucker Meter signal. The second column pertains to the mean dynamic

head developed in conjunction with the analysis of the Tucker meter, and the third column pertains to wave elevations derived from the radar system. The first row in the table is the number of double amplitudes found in the middle 16-1/2 minutes of the sample. Below this are noted the maximum height found and the averages of the 1/10 and 1/3 highest double amplitudes. The final line in the table is the significant (4 rms) height derived from the spectral analyses. Ordinarily it is expected that the last two lines of the table will be about the same.

At the right of any even page are plots of the five computed spectra. It was decided to standardize the frequency scale from 0 to 2 rad/sec. In the great majority of intervals everything of interest is contained in this range. In some intervals one spectrum or another is non-negligible beyond 2 rad/sec but nothing much has been seen beyond 2.5 rad/sec for any of the quantities analyzed except in the stress spectrum where something may often be noticed around the frequency of the first mode of vertical vibration. The folding frequency of the analyses is above 20 rad/sec; no aliasing is expected, Reference 3.

The stress and roll spectra are plotted together. The vertical scale is for the stress spectrum. The roll spectrum has been multiplied by the factor noted in the legend before plotting. Dimensions of the stress spectral density are ($kpsi^2$/rad/sec) and those of the roll spectral density are (deg^2/rad/sec).

All three wave related spectra (Tucker, mean dynamic head, and radar) are plotted together to the same scale. The dimension of the wave spectral density is ($feet^2$/rad/sec). In the wave spectrum plot there is a vertical (slightly joggled) dashed line. This line marks the position of the low frequency cutoff, ω_o, discussed in Reference 4 in conjunction with double integration of the vertical accelerations. It is correct to interpret the position of this line as meaning that the double integration has been done correctly for higher frequencies, and incorrectly for lower frequencies.

There are several details about the spectrum analyses which are not documented in the plots because they are constant throughout the data reduction. First, the normalization of the spectra is such that the spectrum area equals variance. All spectra are derived from a Fast Fourier Transform analysis of an 8192 point sample. The fundamental results is 4096 spectral estimates of 2 degrees of freedom each. These estimates are uniformly spaced in frequency at a delta-frequency of 0.00511 rad/sec. In order to improve statistical reliability, the basic spectral estimates were averaged in blocks of 20 estimates at intervals of 10 estimates. The resulting averages are thus equi-speced on the frequency scale at intervals of $\Delta\omega$ = 0.0511 rad/sec. This also means that adjacent spectral estimates as shown in the plot are not quite independent -- to about the same degree as spectral estimates from the older autocorrelation methods are not independent.

As a result of the averaging, each spectral estimate has 40 degrees of freedom associated with it. Accordingly, the 90% confidence bounds on the spectra shown in the charts may be formed by multiplying the values given by 0.72 and 1.51. Had the process sampled continued indefinitely and a large number of 20.5 minute samples been obtained and analyzed, nine out of ten of these new estimates of spectral density would be expected to lie within the bounds so constructed. The practical implication is simply that the influence of sampling variability upon the given numerical results is roughly the same as that associated with the result of most other full scale wave measurement exercises.

The last detail of the spectrum analysis is the "total degrees of freedom." This number is included in parentheses at the end of each line of legend because it depends upon the shape of each individual spectrum. It is an estimate of the proper number of degrees of freedom to use in constructing confidence bounds on the sample variance. If each of the numbers in the present 8192 point time histories had been picked randomly the "total degrees of freedom" would be 8191. This is not the case -- adjacent members of all the present time series are highly correlated so that the equivalent "random" sample size is much smaller. In the present data set the "total degrees of freedom" (TDF) is expected to vary between 60 and 600. Approximate 90% confidence bounds on the variances assuming a Normal zero mean process, may be constructed by multiplying the estimate by two factors derived from the percentage points of the Chi-square distribution. Examples of the values of these factors are given as follows:

TDF	Factor for Lower Bound	Factor for High Bound
60	.72	1.32
120	.80	1.27
200	.84	1.17
400	.89	1.12
600	.91	1.10

These are factors for the variances. The square root applies to the rms values so that very roughly the 90% confidence bounds on rms range from the sample rms ± 15% for TDF = 60 to the sample rms ± 5% for TDF = 600. The practical implications of these results are quite similar to those mentioned in connection with the confidence bounds on the spectra. There is only so much "precision" obtainable from one 20 minute sample of wave elevation -- that which was attacined in the present work appears comparable to that achieved in the past in similar studies. With respect to comparisons between wave meters or between data and predictions of rms ship responses there can be little justification to a concern about differences of 5 to 15% magnitude.

The sample time histories on the odd numbered pages need little explanation, except perhaps to say that the duration of the sample shown (8-1/2 minutes) was a compromise between a desire to display as much of

AD-A057 005 STEVENS INST OF TECH HOBOKEN N J DAVIDSON LAB F/G 8/3
RADAR AND TUCKER WAVEMETER DATA FROM SEA-LAND MCLEAN - VOYAGE 6--ETC(U)
AUG 78 J F DALZELL N00024-74-C-5451
UNCLASSIFIED SIT-DL-77-1943 SSC-SL-7-22 NL

2 OF 2
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the 16-1/2 minutes of derived wave time histories as was possible in one page; and the desire to spread the time scale out so that individual fluctuations were visible for intervals involving high ship speed in head seas. To produce the charts an 8-1/2 minute portion of the available 16-1/2 minutes of sample was chosen such that the largest radar wave double amplitude is shown -- as well as (if possible) the largest mean dynamic head double amplitude.

It may be fairly asked why the effort in producing plotted time histories for each interval was considered worthwhile. The answer to the question is fairly simple. While the present data in its original analog form has been scanned systematically by eye, the process involved oscillograph records with a time scale of about 15 minutes to the inch. At this time compression only a gross idea of what was happening can be formed, no detailed assessment of the believability of the data can be made, and, most importantly, the odd malfunction which is enough to upset the spectrum estimates or the statistics may often go unnoticed. This last is considered most important in the radar data. It was pointed out in References 3 and 5 that an attempt was made to weed out intervals where the radar had evidently lost signal and re-established a new reference range. In this process only the most obvious instances could be identified; no guarantees could be made that all instances of moderate or small magnitude had been eliminated.

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REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER SL-7-22	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) (6) RADAR AND TUCKER WAVEMETER DATA FROM SEA-LAND McLEAN - VOYAGE 61.		5. TYPE OF REPORT & PERIOD COVERED (9) Technical rept.
		6. PERFORMING ORG. REPORT NUMBER (14) SIT-DL-77-1943
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16. DISTRIBUTION STATEMENT (of this Report)

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17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

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18. SUPPLEMENTARY NOTES

(18) SSC (19) SL-7-22

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

(16) F42270 (17) SF42270306

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

So that more precise correlations between full scale observations and analytical and model results could be carried out, one of the objectives of the instrumentation program for the SL-7 class container ships was the provision of instrumental measures of the wave environment. To this end, two wave meter systems were installed on the S.S. SEA-LAND McLEAN. Raw data was collected from both systems during the second (1973-1974) and third (1974-1975) winter data collecting seasons.

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404 750

It was the purpose of the present work to reduce this raw data, to develop and implement such corrections as were found necessary and feasible, and to correlate and evaluate the final results from the two wave meters. In carrying out this work it was necessary to at least partly reduce several other channels of recorded data, so that, as a by-product, reduced results were also obtained for midship bending stresses, roll, pitch, and two components of acceleration on the ship's bridge.

As the work progressed it became evident that the volume of documentation required would grow beyond the usual dimensions of a single technical report. For this reason the analyses, the methods, the detailed results, discussions, and conclusions are contained in a series of ten related reports.

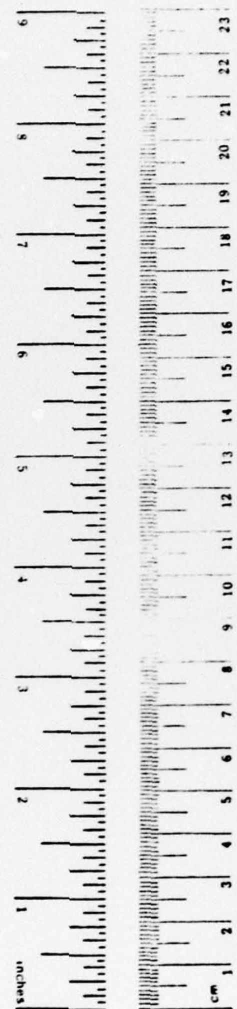
This report is one of the six in the series in which the detailed results of the data reduction process are presented. Included in this report is the reduced data from the Third Season Voyage 61.

METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures

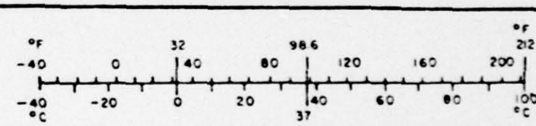
Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
in	inches	*2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
		AREA		
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.8	square meters	m^2
mi^2	square miles	2.6	square kilometers	km^2
	acres	0.4	hectares	ha
		MASS (weight)		
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
		VOLUME		
tsp	teaspoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft^3	cubic feet	0.03	cubic meters	m^3
yd^3	cubic yards	0.76	cubic meters	m^3
		TEMPERATURE (exact)		
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

*1 in = 2.54 (exactly). For other exact conversions and more detailed tables, see NBS Misc. Publ. 286, Units of Weights and Measures, Price $2.25, SD Catalog No. C13.10:286.



Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
		AREA		
cm^2	square centimeters	0.16	square inches	in^2
m^2	square meters	1.2	square yards	yd^2
km^2	square kilometers	0.4	square miles	mi^2
ha	hectares (10,000 m^2)	2.5	acres	
		MASS (weight)		
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
		VOLUME		
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m^3	cubic meters	35	cubic feet	ft^3
m^3	cubic meters	1.3	cubic yards	yd^3
		TEMPERATURE (exact)		
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F



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The Ship Design, Response, and Load Criteria Advisory Group prepared the project prospectus, evaluated the proposals for this project, provided the liaison technical guidance, and reviewed the project reports with the investigator:

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